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## EDITORIAL NOTES.

### The Open Residuals Clause.

IN reviewing the Acts of Local Authorities since the editorial on the above subject was published last week, it has been observed that there has not been a uniform omission during the session of the residuals restrictive proviso, which limits the purchase rights of a gas undertaking to an amount equal to one-third of its own production. But the balance, taking company and local authority measures together, is in favour of the omission; and this should strengthen the hands of promoters in the coming session. The Lurgan District Council Act, it will be remarked from our second article on the Gas Acts of the session, has succeeded without the objectionable proviso in it. We see by the imprint on the Act that the Parliamentary Agents were Messrs. Lees and Co.; and they also piloted the Warwick Company's measure through, which (as was mentioned in an editorial a week since) likewise passed with the model residuals clause in it, but *minus* the restriction. The other Acts that went through without the limitation were, as notified last week, those of the Prescot and Ormskirk Companies, the Parliamentary Agents for which were respectively Messrs. Dyson and Co. and Messrs. Butterworth and Co. We have not yet had an opportunity of seeing all the Gas Provisional Orders; but it is observed that the restriction does not appear in the Heathfield and Waldron Order, for which the first-named firm of Parliamentary Agents acted. The proviso, however, does appear in the Plymouth (in respect of the Devonport Gas-Works), Skegness, and Port Glasgow Acts.

While the gas industry did not want the line of precedents extended for the imposition of the one-third restriction, to have had it deliberately omitted in so many cases this session is a distinct gain for that equality of liberty for gas undertakings with chemical manufacturers in dealing in residual products for which the industry has so persistently and so justly contended, and which the Committee specially deputed to investigate and adjudicate upon the matter held should be maintained. The gain is the result of submissions to the Lord Chairman by representatives of the promoters of the Bills. It will be remembered that, in most of the Bills as lodged for the present session of Parliament, the restricting provision (though in the Model Clause) was not inserted, as there is no intention on the part of the gas industry to relinquish its freedom in this respect without still struggling and protesting against the obvious injustice of making gas undertakings subjective in any way to the purchasers of their secondary products. Naturally, the exclusion of the proviso from the Bills attracted the attention of the Lord Chairman; and he raised the point in his observations on the measures. The matter, we learn on inquiry, was subsequently fully discussed before his Lordship—it being contended that the proviso in the Model Bill, which follows section 45 of the South Suburban Gas Company's Act of 1914, was contrary to the report of the Joint Committee; that the Joint Committee had considered the matter from the point of view of gas undertakings generally, while the South Suburban case was a single one decided by a single Select Committee; that this Company's undertaking was a very large one; and that it could not therefore be compared with the undertakings of the companies and local authorities promoting Bills from which it was asked the proviso should be excluded. On these and other grounds, it was submitted that it would be unreasonable to put the limitation on these companies and authorities. As a result of the discussion, his Lordship agreed to the omission of the one-third limitation, but required the general powers clauses in the Bills to be altered to follow the model residuals conditions in other respects. This alteration gives the gas industry all it asks for. With the model, *minus* the one-third restriction, it will be perfectly content.

In the case of Provisional Orders, it appears that at first the Board of Trade made them all conform to the model, including the restriction. But as previously remarked, the proviso does not appear in the Heathfield and Waldron Order; and investigation informs us that there was success in persuading the Board to delete the limitation when the Bill to confirm the Order was in Committee of the House of Commons. There was no doubt the Board of Trade were influenced in this course by Messrs. Lees and Co. being in the position to point to the excision of the proviso in the case of the Warwick, Prescot, and Ormskirk Bills. Whether it was omitted from Bills confirming other Board of Trade Provisional Orders, we are not yet in a position to say.

The varied experience in this matter during the session raises both hopes and fears. It is hoped that the objectionable and unfair restricting proviso will henceforth be generally omitted; but there is doubt as to whether or not the view the Lord Chairman takes is that there should only be omission in the case of what may be described as the smaller undertakings. However, in view of the precedents for full residuals liberty that have been instituted this session, and of the inestimable service that the gas industry is rendering to the country through its residual products and the extraction from the gas of toluene for high explosive purposes, the hope is entertained that the parliamentary authorities will henceforth see it is in the best of national and economic interests that free trading shall be maintained in the secondary products of gas manufacture.

### A Universal Calorific Standard for Canada.

IT has been observed before that when Canada makes a new prescript regarding its gas supply, it does it thoroughly, after due inquiry, and not piecemeal. For some time past, consideration has been given, by the authorities concerned, to the question of the adoption of a calorific value standard to apply universally throughout the Dominion; and now an Order in Council has been issued which decrees that henceforth the standard of gas supply is to be a calorific value one, and it is to be 520 B.Th.U. (total heat test). Canada may pride itself upon the fact that, if it was not the first country to adopt a calorific value standard, it is the first to universally institute such a standard. The governing regulations are very explicit indeed; and for a copy of them, we are indebted to Mr. Ormond Higman, of Ottawa, the Chief Engineer of the Electrical Standards Laboratory of the Department of Inland Revenue.

The fixing of a standard of 520 B.Th.U. (total heat test) is interesting. This figure has not been selected by any haphazard means; but very careful consideration has been given to it. Considerable pressure was brought to bear on the department to adopt the largely applied American standard of 600 B.Th.U., rather than the British standard of approximately 500 B.Th.U., which is what the 540 B.Th.U. really mean with a $7\frac{1}{2}$ per cent. allowance before penalties begin to obtain. However, the department properly resisted this pressure. In doing so, they have studied not only the interests of the gas undertakings, but of the gas consumers; for in a 600 B.Th.U. gas, there is not the degree of flexibility and good heating service that there is in one giving about 500 B.Th.U. The consumers lose much heat by the degree of aëration that the higher grade gas requires, and by the difficulty of obtaining an adequate admixture of air with a gas of such constitution. The cost of producing the higher grade gas is also necessarily higher than that of making the lower and more serviceable quality. The department, therefore, in adopting a standard of 520 B.Th.U., instead of one of 600 B.Th.U., have followed a real economic course. In deciding on a standard, too, to have application throughout the Dominion, a figure has been settled upon which investigations give assurance can be worked to under all the prevailing conditions of manufacture. We are not particularly enamoured of a uniform figure as a standard, especially in a

country as here where the most available coal supplies vary so considerably in different localities in their gas-making properties. But no real objection can be raised to a standard to which it is possible for all undertakings to work—from the worst placed to the best placed for their raw materials.

Save in two other respects, the regulations follow closely the lines of our own parliamentary model. The first exception is that it is open to anybody, at any reasonable time, after depositing the necessary fee (amount not stated), to have a test made of the calorific value of the gas. In the event of the calorific value as determined by the test being found below the standard, the cost of the test is to be paid for by the undertaker; but if the result is at or above the standard, the charge is to be paid by the party whose inquisitiveness led to the special test being made. This prescription does not appeal to us as being a very useful one, where the ordinary testing authorities regularly perform their guardianship functions in this matter. However, the provision cannot do any harm; and there may, admittedly, be times when it will come in useful. The other difference from the British prescription refers to the penalties. There is a sliding-scale of penalty according to the number of meters that a defaulting undertaking has connected-up—that is to say, the penalty increases by graduated steps according to the number of meters, and therefore according to the number of the consumers who suffer from the default of the suppliers. For our own part, we prefer the British mode of having an advancing penalty according to the degree of default. But there is no provision for this in the Canadian regulations; so that there would be no greater penalty for a large than for a small lapse from the standard. We cannot see how penalties based on the number of meters could be applied effectively to the gas undertakings in this country, with connections ranging from a few hundreds up to (say) about 800,000 in the case of the Gas Light and Coke Company. Some of the undertakings, too, have more than one manufacturing station; and the gas being distributed from one station might be well above the standard, while that from the other was below. In such circumstances, the meters fixed would prove a very ineffective basis for the penalties. However, the main thing is that Canada deserves hearty congratulations over the progressive move it has made in relation to its gas supply.

## The Coal Position, and Tar Washing of Gas.

It was an ample and interesting programme that was arranged for the meeting of the North British Association of Gas Managers last Friday. In addition to the address of the President (Mr. J. B. Scott, of Cowdenbeath), there were four papers, and, among other matters, opportunity was taken to do honour to Mr. G. R. Hislop, *doyen* of the gas profession of Scotland, who is venerated for all he has been, and all he is, not only by the section of the profession across the Border, but by members of the profession throughout the British Isles.

The address of the President was a frank and thoughtful production; in the main picturing the adverse conditions and effects produced by the war—an accumulation of both such as the industry has never before experienced during its long and progressive career. It has been accustomed to adversity as well as to prosperity, and has always successfully ploughed through the former to more open waters. But such adversity as has been experienced in the past has been (as we now view it, if we did not at the time of happening) light and colourless compared with the heavy, sombre difficulties of these times. Yet such is the vitality of the industry, and the grit of those at the helm, that it is sailing through the vastly troubled waters with merely an amount of injury which is now fully measurable, and which is being kept well in check.

Among the difficulties has been, and is, that of coal. The President is fully in agreement with the prohibition placed upon the free export of coal; and this he is convinced is of more importance to the home industry than is or will be the Price of Coal (Limitation) Act. So far we agree. But the Act is supplementary and essential to the prohibition, without licence, of the export of coal. Mr. Scott does not appear to think that the Act will be of any particular value in the lowering of the price of coal—in fact, he is of opinion that some undertakings may be worse off owing to its existence—his own for example. This is purely a matter of conjecture; and it does not take into account what might have been had the Act not become law. There are some gas undertakings with contracts made since April 1 at prices 5s., 6s., and 7s. above the pithead prices which ruled in their previous contracts. They can benefit if they choose; and managers who do so choose will not see eye to eye with Mr. Scott. There are other managers who have only entered into their contracts since the Act became law. They too have reaped advantage. Can the President inform us to what figure the price of coal would likely have risen, despite reduced export, had restraint not been imposed by the Act? Also with exports largely diminished, which would have paid the coalowners the better, to have put into the home markets a supply in excess of the demand, or to have refrained from any movement to supplement supply in order to command high prices and profits? The questions are merely put for consideration; we do not ask for, nor expect, an answer—it would, in fact, be useless to attempt to predict just what would have happened. Without the Act, the future would have been speculative; but there is nothing speculative about the position now. It is, under the current conditions, to the interest of the coalowners to give the country as much coal as it requires, and to get the best price possible within the limits of the law. The Act is not for to-day only; it is for every to-morrow, until the hyperbolical circumstances created by war do not intervene in our ordinary trading. The Act is for our common protection. It would never do to argue that because ninety-nine people out of a hundred may never have actual recourse to the common law of the land, that the common law is of no value to them. While of advantage in the case of the hundredth person, its very existence is a standing protection to all the others. The same with the Coal Prices (Limitation) Act; it will protect. The pre-existing menaces were too vivid to be hid from the observant; hence the *raison d'être* for the measure. But though the President indicates his opinion that there is nothing very much in the Act, he subsequently complains of the omission of non-statutory undertakings from the retrospective clause. We are with him there, so far as public services are concerned. But it is clear the Legislature had difficulty in arbitrating between various interests, and in drawing the line at a point that would be fair. So they drew it at local authorities, statutory companies, and household coal. It would be a somewhat difficult thing to define precisely what is a "public service," or, to use Mr. Scott's term, "public necessity."

Out of much else entering into the composition of the address, emerge as of special interest the President's references to the washing of gas by tar. By this process gas undertakings are doing something that they would possibly never have done had the war not made it imperative. Tar-washing of gas would have been scouted by many as liable to do grievous injury to the gas; but the President testifies that he has increased the light oil content to six times the original amount, without doing any serious injury to the gas. It is all a question of the proper temperature at which the washing is conducted as to whether any substantial injury is inflicted upon the gas or the tar. Mr. Scott agrees with the use of a tower scrubber for the purpose; that is becoming the general view. The only thing against which small works have to guard is that their ammonia extraction does not suffer, if their scrubbing plant has no margin in it to devote to tar-washing. The President is also of opinion that as yet all gas-works are not being adequately remunerated for the increased value of the tar. That is certain; and it is a matter that was dealt with in articles in the "Journal" for July 20. Here we must leave the address, as the papers supply other topics for notice.

## Commercial Problems of Sulphate of Ammonia.

Long-established custom and convictions are as difficult to break through as the Dardanelles; but just as the joint fleets of Great Britain and her Allies, with the land forces, will succeed with their operations in the Near East, so old custom and convictions that still exist among some makers of sulphate of ammonia will in time be broken down, either through their own good sense or by the compulsion that the strength of new conditions will exert by producing disadvantage for those who still live in the commercial past. The Sulphate of Ammonia Association are carrying on a persistent campaign in this connection; and the day will dawn when every British producer of the commodity will thank the Association for their foresight and perseverance—a perseverance which led Mr. F. C. O. Speyer to read, on their behalf, a paper on the subject at the meeting of the North

British Association. The campaign must not be relinquished until the ranks of those who realize what is before British sulphate of ammonia, and have shaped their course accordingly, are lengthened to the fullest possible extreme.

What is it that the Sulphate of Ammonia Association are preaching and teaching so assiduously? It is that the conditions under which producers are working, and will have to work more strenuously in the future, have, with the progress of time—through enlarged production, and new invention, which has given rise to new competition—been altogether reformed, and in such drastic manner that commercial practices must be immediately remoulded. The new practices and policy, however, are not very readily being universally accepted. The singular thing about this scattered reluctance to accept is that the Association are not putting forward mere shadows for the purpose of inducing acceptance, but very material facts, which should appeal to the most obtuse intelligence. Sulphate of ammonia must not be looked upon and treated as though it enjoyed a real monopoly. It never has done so; and it is as certain as anything temporal can be that British sulphate of ammonia will meet with vast resistance in the markets in the future, and will have to be prepared for a constant tense struggle. Let us see. Is it not a material fact, and an ample full justification for the policy of the Association, that the world's production of nitrogen in the shape of fertilizers has been increased with vast strides of late years? Is it not a material fact that the increase has now no limits save the one that makes production profitless? Is it not a material fact that competition has been so rapidly enlarged that the new comers were in actual competition before most of the older producers of sulphate of ammonia were aware of it? While some of these old producers opened their eyes with surprise, others were sceptical of anything having happened that was more than a fanciful and an impracticable notion, which would vanish from the scene as promptly as it came on to it. The answers to all the questions must be in the affirmative. In addition to the world's production of sulphate of ammonia enlarging quickly from coal carbonization and by increased recovery from coke-ovens, in addition to the old competition of nitrate of soda, there were before the war actually in trading existence synthetic sulphate of ammonia, and cyanamide or Norwegian nitrate of lime; and production from these sources is going to increase enormously. What is the conclusion to be drawn from this? It is, as Mr. Speyer puts it, that, "after the war, competition in the world's nitrogen "market will be more severe than ever before, and that this "competition will inevitably have the effect of reducing the "level of price by many pounds per ton unless old markets "can be developed, and new outlets be found." By many pounds per ton! This alone should be a serious, thought-provoking, and mind-disturbing statement. Mr. Speyer cannot be accused of being an alarmist prophet. What he says is the practical and the only deduction that can be made by a man looking the cold facts straight in the face.

That, then, is the situation. Producers may try to fence with it, and may attempt to encourage the idea that the old methods will fit quite well the new conditions. To speak plainly, with the facts fully before us, those who do this are living in a Fool's Paradise; and they will find it an extremely uncomfortable place of habitation. Those who appreciate the situation have, like wise men, been considering how best to deal with it. The problems are commercial ones. Educational propaganda must continue. But the commercial problems must be dealt with; and upon these the Association have been concentrating attention. This is the part of Mr. Speyer's paper that has freshness; and it is the part over which the resisters—those who, disregarding the protection of their future in the sulphate of ammonia business, want to make the ultimate penny in the present from their production—will be disposed for controversy. We will only skim the proposals, and leave the argument as it stands in the paper, and for two reasons: First, that, with the facts of the situation well in mind, the proposals commend themselves; and, secondly, that those who are opposed to the policy of the Association in this matter have not disputed the fact as to an immense competition looming on the horizon (which competition will become very effective with the return of peace), and have not proposed any alternative schemes for meeting it. To consolidate and extend the consumption of the British production at home and abroad, and to preserve the markets to British production, the Association, in the first place, ask the makers to encourage the manure and agricultural merchants—the men in closest touch with the farmers—to stock sulphate of ammonia. This can only be done by the producers making it a rule to keep their price to the farmers 10s. per ton above the price to the merchants. Here we come up against the first difficulty. There are those who want to know why they should give up anything to the middleman. The whole point is whether the agricultural merchant is a factor in the situation—whether he is in a position to help to establish and consolidate the position of sulphate of ammonia among the users of fertilizers. The business relations of the one and the other do not give any room for doubt; and in creating permanence and a broadened market, the assistance of the merchant cannot fail to be invaluable. Mr. Speyer discusses the point as to whether the 10s. is really a sacrifice, inasmuch as already 3½ per cent. is allowed to the export merchant. He cannot see that it is; and all that is asked is that the 3½ per cent. shall be granted to the home merchant, and be made up to 10s. where it does not amount to this sum. Prudence and protection claim something from the producers, although we cannot see where there is anything that can be called a "sacrifice" in assuring a larger market than could possibly be obtained and retained by the efforts of the producers if externally unaided. The greater sacrifice would be in encouraging the merchants to favour a competing exotic fertilizer.

But the more important part of the commercial scheme is in the proposals of the Association for avoiding rapid price fluctuations, which are an abomination in the eyes of the agricultural merchants. These fluctuations are a decided drawback to them in laying in stocks; and if their good offices are to be obtained in developing and holding markets for sulphate, something must be done to give them greater security. Firmer prices can only be realized by producers refraining from spoiling each other's markets by competing and underselling, and by giving longer tenure to prices. The proposal is for prices to be fixed monthly, in given districts, by a local committee of producers, for 24½ per cent. and 25 per cent. ammonia. It is true that this plan means the supplanting of competition by combination; and this will be objectionable to those producers who are strong adherents to Free Trade principles. We have, however, to consider the demands of the situation—consider whether this is not a case where expediency can, to the general advantage, over-ride political maxim. This appears to us to be such a case; for the fixing of prices cuts both ways, and the competition from fertilizers produced other than as a result of the carbonization of coal will assoil from any serious breach of principles those who follow the Free Trade banner. The matter is open for discussion. The Association want it discussed. If the general line of the scheme meets with approval, then the Association propose to organize the producers into suitable territorial groups, and develop the plan.

There is one other point regarding the commercial position, and that is the quality of the commodity. This is a subject that we have freely and frequently discussed; and so will not touch upon it on this occasion, though Mr. Speyer does so in his paper. But, generally, the commercial position of sulphate of ammonia cannot be too much discussed until the seriousness of the position—not the immediate position, but the prospective one, and nobody can tell how soon this may be upon us—is universally realized by the producers of sulphate, and there is perfect unity in setting out to meet it.

## Broadening the Knowledge and Skill of Fitters.

No apology is needed for frequently turning attention to this subject. Given cheap and good gas, and excellent appliances, the reputation and progress of the industry are largely in the hands of the fitters employed; seeing that the realization or the marring of the best efficiency of the indispensables the one to the other—the gas and the appliances—depends largely upon the degree of efficiency of the man who has to instal the latter. A neat paper on the subject of the training and education of gas-fitters was presented to the members of the North British Association last week by Mr. R. W. Cowie, of Dalkeith. He is optimistic on good grounds as to the future of the gas industry. There is a grand scope for expansion lying all round. Advancing civilization has only commenced to turn man from the barbarous sacrifice of raw coal for the single purpose of producing heat to the use of gaseous fuel. Every kitchen, every room, every factory, every gallon of water the temperature of which has to be

raised, offers an opening for business in gaseous fuel. And we are not at the end-all yet of the progress in the economy and efficiency of our appliances. Thinks anyone that, with all the science and skill that are being applied to the construction of gas-fires and other heating apparatus, nothing farther will be achieved? We have faith in manufacturers, and look upon all the knowledge that has been accumulated by them as one of the gas industry's assets and guarantees for the future. All the aids to commercial progress that are being brought to bear within the gas-works, and within the ancillary factories of the manufacturers of gas appliances, must not be spoilt by gas undertakings neglecting their duty in seeing that the knowledge and skill of their fitters are equal to the demands. The smaller works are not so well placed as the larger ones for promoting educational work among fitters; but Mr. Cowie describes what has been done in Edinburgh as well as by himself independently in a much smaller sphere. It occurs to us that some arrangement ought not to be impossible between large undertakings and the surrounding small ones for co-operation in the technical study and practical work of fitters, so raising ability and efficiency all round. There is something in this for the consideration of the larger gas undertakings. The reputation of the industry for "good works" in its lines of business does not rest upon what one gas undertaking does, but on what they all do. The work of gas undertakings is reciprocal. The manufacturer is a substantial customer for industrial purposes of the large gas undertaking in the city or town; but the manufacturer and his family reside some miles out in a district supplied by a small company. It is to the interest of the large gas undertaking that the manufacturer should be pleased not only with the work performed by gas in his factory, but that his good opinion of gas as a servant should extend to his home. The remarks of Mr. Cowie on the subject of examinations so fits in with our own views that there is no necessity to comment on them here. But the principal object of his paper is to help the movement for increasing the fitness of the gas-fitter for the industry's work in the present, and to make him a live factor in that progress which is a certainty if our forces are properly marshalled and their efficiency placed upon, and maintained at, the highest possible level.

## A Simple Pressure-Wave Inducer.

"Necessity is the mother of invention." A very simple method (with a twelve months' working record testifying to its efficacy) of promoting pressure waves in connection with the distance automatic lighting and extinguisbing of public lamps, was described at the North British meeting by Mr. James J. Scott, of Lower Largo. Under his particular circumstances, the processes of producing the necessary pressure waves which first occur to an engineer were not available to him, or he could not readily apply them. Mr. Scott therefore devised a little steam-injector in connection with a main-pipe, with drip-box and bye-pass (the latter to avoid the station governor, and its connections); and with this very modest arrangement, he accomplishes his purpose. On opening the steam-valve slightly, the action of the steam passing from the injector through a conical "horn" carries the gas at high velocity into the district main, gradually increasing the pressure, which, in turn, automatically closes the governor—thus preventing the gas passing back to the holder. That is all; and the arrangement is reported by Mr. Scott to be highly effective and controllable. The operation can take place with any pressure of steam from 5 lbs. per square inch upwards; by controlling the quantity of steam, any desired pressure can be realized; and the time required is under the full control of the operator. There is the point as to the effect of the steam other than for its destined purpose. The quantity needed is really negligible; and as one would anticipate having regard to temperature, the steam is condensed within a few yards of the point of ingress, and flows away to the nearest drip-box. Mr. Scott is so pleased with the working of his device that he sees for it a useful career in connection with both large and small works, and a range of service extending beyond that for which he designed it.

## Official Testing and the Accuracy of Gas-Meters.

The testing of gas-meters is not one of the controversial subjects that engage the attention of gas engineers at their meetings, though the proper testing of meters is of the utmost importance to them. A matter of greater moment is that, when once tested and not found wanting in accuracy, the meters shall have a long and unblemished life; for, on the proper working of the aggregate of meters in a gas-supply area, there is a large financial responsibility, and much depends on them in relation to the aspect of the figure representing unaccounted-for gas. But in respect of the actual work of testing, the guardian Legislature has largely divorced the interest of the gas man from it, by, as is right, placing the work in the hands of independent bodies. However, it is of extreme interest to hear, as the members of the North British Association heard, at their meeting last week, of the experiences of an official, such as Mr. William Gordon, of Edinburgh, who is daily engaged in this work. We are rather inclined to think that, if such officials and gas engineers got into closer contact (there could be no question of interfering with the liberty of the former), something more than has hitherto been done could be accomplished towards amending the antiquated legislation applying to the testing of meters, as well as in devising and perfecting new apparatus for meter-testing under the fresh conditions brought into being by high-pressure gas distribution.

It is useful to have Mr. Gordon's independent testimony as to the perfection that obtains in these days in connection with gas-meters. When he tells us that during the past three years, he has had to reject for inaccuracy only 0·73 per cent. of dry meters and 0·24 per cent. of wet meters, the information can be accounted good. Still further evidence of perfection over a range of conditions which may fairly well come within the description of normal variations is given in the references in the paper to a test of a 5-light meter (taken indiscriminately from stock) at pressures ranging from 0·5 inch to 4 inches—the gas passing being maintained uniform at 30 cubic feet per hour. The result was that at all points between the two limits of pressure named, the meter stood constant at 1·01 per cent. fast. A further test was made between 0·5 inch up to 3 inches pressure with the consumption increasing by steps between 30 cubic feet at 0·5 inch pressure and 75 cubic feet at 3 inches pressure. After the pressure of 0·5 inch was passed, there was complete accuracy with the higher consumption at each successive stage of testing. These tests go to show that the gas-meter is now an instrument possessing a high degree of exactitude; and in view of the ancient condition as to pressure in the Sale of Gas Act, such testimony as this shows how well the meter manufacturers have, without any official compulsion, kept abreast of the need for meters to register correctly at the different pressures now more or less normal, and at the different consumptions represented by that of a single bijou gas-burner up to a fairly heavy simultaneous lighting, heating, and cooking consumption.

On the vexed question as to the special testing of indices, Mr. Gordon appears, contrary to some of his colleagues, to think that this would be a work of supererogation, and that the expense would not be justified. It would be folly to unnecessarily increase work and expense; but there have been examiners who—perhaps with other makes of meters—have not found all indices possess the right to freedom from censure. In his references to high-pressure meter testing, Mr. Gordon does not mention the statutory powers obtained last year by the London County Council and the City Corporation. It is clear that he is not satisfied that there is yet the right apparatus in existence for accurately testing high-pressure gas-meters; and he is persuaded that the devising of such apparatus is work that requires very critical investigation. In connection with high-pressure distribution generally, he suggests the advisability of gas engineers agreeing upon a maximum pressure, as he thinks this would enable the manufacturers of the apparatus for utilizing the gas to standardize their wares. In offering this suggestion, Mr. Gordon appears to be a little out of touch with the practice demanded by varied need. In single districts—especially industrial ones—there is a great difference between the high pressures required for the various operations. The maximum pressure requisite in Birmingham, with its diverse industrial operations, may not be the pressure wanted in an area where lighting and perhaps one or two industrial purposes sum up requirements. According to the distance the gas has to travel and the draught upon the mains, the maximum pressure at the works must also vary. But uniformity is obtained by governing-down to the necessary pressure at each point of consumption. Under the varying conditions which define the most appropriate local maximum pressure, it would be impossible to fix upon a uniform figure for all high-pressure systems.

### Responsibility and Reputation.

Sixty-six years of gas management is a good innings. Few have ever claimed it; and probably comparatively few will ever be able to. There are, however, several instances on record of the service of a gas official to one undertaking for half a century. Mr. George R. Hislop is an example; and on the completion of his fifty years' service at Paisley, and sixty-six of gas management, the members of the North British Association desired to mark regard and friendship for him, and appreciation of the work he has rendered the industry. This they did at their meeting last Friday, when the President (Mr. J. B. Scott, of Cowdenbeath), in phrase and thought equally eloquent, asked his acceptance of an illuminated address. It was a graceful act, and the recipient, as all in the industry knows, is well worthy of it. There are two sentences in the reply made by Mr. Hislop, which ought to be marked well. "The importance of the industry carries with it a corresponding responsibility on those associated with it." That is one sentence. The importance of the industry grows, and so does responsibility. But this is not recognized by all in administrative and executive positions. Mr. Hislop also urged the men of the profession to do and act so that the world might know that in the industry "there were to be found men of skill, capacity, and administrative ability, who were altogether well qualified to discharge the duties that devolved upon them."

### Gas Washing by Tar or Creosote Oil.

In another part of the "JOURNAL," an interesting and valuable article appears, from a "Coke-Oven Expert." In this, he gives us his views from large personal experience on the subject of the extraction of benzene, toluene, &c., from coal gas, and places these experiences at the service of the gas industry in connection with the practices that are at the present time being pursued by it. The portion of the article that will perhaps arrest in greatest measure the attention of gas engineers, who are doing a good part in supplying the country with toluene by the treatment of their gas is towards the end, where are discussed the relative merits of washing gas by tar and by oil. In coke-oven practice, a light creosote oil is employed for the purpose in view; and the coke-oven practitioners are strongly averse to using tar, or any washing medium containing tarry matter, for relieving the gas of the needful constituents. The reason that tar-washing has been so largely adopted by gas-works is that, while tar may not have such a high absorbent efficiency as creosote oil, the country's requirements demanded quick work and results. Scrubbers and tar, with little expense attaching to the introduction of a fresh process, were available on most works; and enriching the tar by useful light oils, and particularly toluol, had prompt and efficacious results. In deciding upon adoption, consideration was not given so much to comparative efficiency of processes as to the point of expeditiously and economically lightening the pressure upon the country for toluol supplies.

### Some Considerations.

Our contributor submits an interesting elucidation of an observed action that takes place in the washing of gas as practised at coke-ovens and in the process Dr. Davidson proposed. It is this, that a stream of gas passing through oil already saturated with recovered products brings about an evaporation or vaporization of the products similar in effect to fractional distillation. The gas takes the place of heat, and the oil—having the greater affinity for toluene, xylene, &c.—acts as the dephlegmator; so that the lower boiling-point products pass forward, and the higher ones are retained. An experiment with a rotary washer, and without adding benzol to the wash-oil, showed our contributor that, by correct limitation of flow, most of the toluene, &c., can be retained in the oil while most of the benzene is carried forward in the gas. The fall in calorific value did not exceed 3 per cent. of the net value. Another point made is that the lower efficiency of tar-washing compared with creosote oil necessitates a corresponding increase in scrubbing area; or, to put the matter in another way any works using an apparatus to scrub the gas with tar could, by using creosote oil, realize three times the output of toluene in the same apparatus. There is matter here for discussion by the experts. At the moment, it has to be repeated that the choice of system by gas-works has been largely governed by expediency.

### Lighting of Factories—First Report.

The first report of the Departmental Committee on Lighting in Factories and Workshops has been issued; and it is an important document, with a medley of valuable detail in the appendices which requires some one with the time and ability to go through it carefully and critically for the purpose of separating the wheat from the chaff. The report itself is somewhat diffuse; but the recommendations are excellent up to a point. Some of them, however—such as those proposing minimum foot-candle illumination—would require, if penalty legislation ensues, an illumination expert on the staff of every factory to see that the illumination does not fall below prescription. They would also add greatly to the work of Inspectors of Factories and Workshops, and would mean an increase in the staff of Inspectors, if, in addition to current work, artificial illumination tests had to be carried out, and after civil service hours when darkness reigned. The Committee have not yet completed their work; but we may already compliment them on the thorough and persistent manner in which they have been going about it, and upon the large range of investigation undertaken to get at a basis of procedure, for this is entirely new and difficult work—difficult owing to the enormous dissimilarity of work.

### Importance of Deficiencies.

We are all agreed, and have long been agreed, that proper illumination in factories and workshops is important from the points of view of preventing accidents, of contributing to the preservation of health and eyesight, and of promoting output and quality—in short, it is an economic question with many sides, and great value attaching to each. The Committee appear to have kept a respectful distance from giving any public expression of opinion as to the relative ill-effects of different light sources upon the eyes, so as to guide the factory owner as to which is the least harmful in the matter of intrinsic brilliancy. As to safety, too, there does not seem to be any guidance as to whether in factory lighting, especially where a large number of female operatives are employed, it is preferable to have a system of lighting which, owing to a single mishap, may cause a collapse of lighting throughout a building, or whether it is better to have a system of which only individual points (if ever) fail, and then can be promptly restored. However, there are good recommendations in the report, though we should have been glad if the Committee had been able to invent some simple means by which the factory owner could ascertain whether his lighting was quantitatively up to standard. We cannot conjure up a picture of the factory owner dabbling in measurements of parts of a foot-candle on the horizontal plane at floor or working level. Still, he may screw-up sufficient interest to study the full description of technical terms given in the report. The "Memorandum" epitomizing the report and recommendations is published elsewhere, together with (*in extenso*) the recommendations and conclusion. We may have an opportunity of further discussing the report.

### Radiant Heat Distribution.

A fresh subject has been raised for discussion and experiment by the article describing the new Richmond fire, and the leaderette thereon, which appeared in last week's issue. It is a good thing to keep interest alive in a direction in which the potentialities are so great as they are in domestic heating. Among the communications on the question is one (which is for publication, and so appears in our "Correspondence" columns) from that excellent and competent critic, Mr. Jas. W. Wilson. He evidently sees little benefit in the new design, the primary object of which is to increase the field of radiant heat distribution, and the secondary object to gain additional appreciation and thus popularity. Mr. Wilson apparently cannot see that the new construction does extend the field of radiant heat distribution. The straight front, he writes, with the radiant heat travelling in straight lines "*in all directions* [italics are desired by our correspondent], not merely at right angles to the front but sideways, would effectively warm anyone sitting with a chair on any part of the hearth rug." No one has said the contrary. But instead of writing thus vaguely, we should like Mr. Wilson to say positively if his opinion is that the radiations proceeding "side-ways" from the straight-fronted fire are co-equal in direction and aggregate intensity with those from a fire with semi-circular front. To contend that they are would suggest that the sideway radiations

from the flat-faced fire had made a departure from the "straight" path, and had assumed a certain obliquity, which is against the law they ought to obey. We quite agree that a straight-faced fire will warm anyone sitting with a chair on any part of a hearth rug, providing the area of the hearth rug is not an abnormal one. No sitter, Mr. Wilson also says, would wish to be behind the line of effective radiation. Certainly not; and the semi-circular fire carries the effective line further back.

### Other Directional Idiosyncrasies.

The next point submitted by our correspondent is that "the straight front has not been condemned, because there is too much heat in front." The use of the word "condemned" is rather strong. No one has "condemned" the straight-faced fire; what has been done is to suggest a larger and more effective distribution of its radiations by a new line of fuel placement. Following upon the words quoted above, Mr. Wilson remarks: "So we assume that the semi-circular front would have to give equally as much heat from the front to be effective. To make the sides effective, an increased amount of heat would have to be provided, which means bigger gas-bills." The argument is a plausible one; but has Mr. Wilson himself "overlooked" what we had not "overlooked" last week, that radiations travel in straight lines "in all directions" within the limits of the confinement of the incandescent material. Radiations will travel in "straight" lines right ahead from a semi-circular front just as from a flat-faced front. All that the new line of fuel disposition does is to increase the scope of travel of the radiations. A further objection by our correspondent is that "a view from the side would only take in half the heat area, but with a straight fire the whole is visible." The latter statement depends on the position of the person viewing the fire. This point we have tried from all angles; and there are positions at the two extreme ends of the large family semi-circle round a fire on the cold winter's night, where a half view will be more comfortable and congenial than no view at all. But that is a comparatively small matter. The point of most importance raised in Mr. Wilson's letter is that it is not possible to protect the semi-circular front from side draughts as one can a straight front. All fires are not exposed to side draughts. The point has, we know, been well in the mind of the firm in designing the fire; and it has been placed under long test. Mr. Wilson will admit that the proof of every pudding is in the eating; and the Richmond Company, we have no doubt, are quite prepared to abide by the verdict of practical experience. Nor have straight-faced fires been ejected from their productions. The semi-circular form enlarges the field of choice; and trials have satisfied the makers that it has advantages, which may be taken as "compensations" for any losses sustained, given a normal room, and not one with draughts cutting in the backs and legs of those sitting sideways to the front of a fire.

### Welsh Coal Settlement.

The trouble in the South Wales coal-field has come to an end; and we all breathe freely again. No one intimately concerned in the dispute has cause to be proud of his part, and especially the many thousands of miners who compelled submission (however just their case) by the force of numbers and a cessation of work in the midst of the most critical times in our national history. Opportunists never had such favourable occasion, however much dishonour marked its use. What simply occurred to produce a settlement is, as all the world now knows, that the coalowners consented to a supplementary agreement bringing the enginemen, the pumpmen, mechanical staff, stokers, and banksmen who perform work on the afternoon and night shifts, within the operation of the "bonus turn"—the five afternoon or night shifts in a week which are reckoned as six—and making the award as to wages retrospective to Aug. 20. Regarding the general subject of the suspension of the Mines Eight Hours Act in order to increase output, it has been decided, at a Home Office conference, not to disturb existing arrangements, but to continue the efforts to reduce absenteeism, which, combined with the limitation of exports, ought to prove sufficient. Should this not be effectual, then the question of the suspension of the Act will be revived for further consideration.

### Differences of Opinion.

Discussions of interest to ratepayers, as such, and gas consumers took place at the meetings of the Councils of Wigan and Stockport last week, reports of which will be found in the news columns of this issue. The topic is, of course, anything but a new one; but present circumstances perhaps lend added force to some of the arguments. In Wigan, as in other places, it is necessary to raise the price of gas, to meet abnormal costs; and here the discussion had its rise in an endeavour on the part of certain members to show that the proposal of the Gas Committee was not sufficiently drastic to meet the requirements of the case. The point about the matter, however, on which the consumers will most keenly fix their attention is to be found in a declaration on behalf of the Committee that, though in the past they have given money to the relief of the rates, as now constituted, they have no intention of giving any more. Had times been normal, their intention had been to reduce the price of gas according to the profits made, so that the small consumers should have the benefit. Thus the proposal to increase the price was made along with the promise that, whenever the Committee found they were making a profit, they would give it back to the consumer. This is good news for those who use gas; and seeing that the Committee have doubtless no power to bind their successors in a matter of policy of this kind, the consumers will certainly hope the Committee may remain "as now constituted" long enough to carry their promise into effect. The discussion at Stockport arose out of the presentation of the Borough Treasurer's annual statement of accounts; and many of the points raised were in connection with matters which had been introduced at an earlier meeting, when the report of the Gas Engineer for the past financial year was submitted. On that occasion one member had argued that it was an injustice to the consumers of gas "that they should be saddled with such a continual increase of borrowed money;" and the reply to this of the Chairman of the Finance Committee is that it is wrong to assume that the gas consumer finds the money for the gas-works. He maintains that the ratepayer finds it; and so the difference of opinion must remain.

### The Restraining Influence of Nitrogen.

There has often been reference to the point that the larger the quantity of air a gas requires to realize perfect combustion, the greater the volume of products of combustion, through the increased quantity of incombustible nitrogen which travels in and away acting as a vehicle for heat which could be utilized to advantage in practical work. In an article in the "Times Engineering Supplement," on the "Uses of Intense Heat," it is pointed out that nitrogen is partly responsible for the fact that combustion furnaces cannot produce such high temperatures as the chemical and the electrical furnaces. It has a restraining influence on the flame, and prevents an excess of oxygen from reaching the combustible material. The writer goes on to explain how, by simple mechanical means, nitrogen can be driven from association with the oxygen of the air. A drum is fitted with fixed vanes on its inside circumference; the outside shell being perforated. Air is forced through this while it is revolving at a high speed. The heavier constituent of the air is driven outwards by centrifugal force; and, as the air for combustion purposes is drawn from the centre of the drum, a greater quantity of oxygen passes to the furnace than would otherwise be the case. It is added that in a factory where an adaptation of this idea was tried commercially, it was found that the same amount of steam could be raised as before with a saving of 27 per cent. of the coal bill. Is there not a suggestion here for some of our makers of gas appliances in which high temperatures, increased economy, and working efficiency, are desired?

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**Photographic Records of Gas-Meter Readings.**—Last Tuesday the "Daily Telegraph" published a message from their New York Correspondent to the effect that gas-meters in New York will hereafter be read by photograph. Meter-readers employed by the Consolidated Gas Company will be equipped with small cameras, which fit over the indicator on the meter. By pressing a button light is thrown on the dial and exposure made showing the amount of gas consumed since the last photograph. These photos are to be kept on file by the Company for the confutation of people who object to the size of their bills. Alluding to this proposal, the "Manchester Guardian" remarks: There is something very characteristic and most impressive about the profound American distrust of the five wits with which Nature has moderately endowed us. Wherever any one of them, or their accumulated result, can be replaced or supported by machinery, sooner or later the community on the other side of the Atlantic will supply the machinery.

## DEATH OF MR. ADAM MACPHERSON.

A well-known member of the gas profession in Scotland has passed away, to the keen regret of a very wide circle of friends, in the person of Mr. Adam MacPherson, who died last Wednesday in Edinburgh. The sad event was the object of sympathetic reference by the President (Mr. J. B. Scott) at Friday's meeting of the North British Association of Gas Managers, of which the deceased had been twice President, and of which he was elected an honorary member in 1904.

Mr. MacPherson was born in the city of St. Andrews; and on the completion of his education, he was articled to Mr. Jesse Hall, at that time Manager of the gas-works in the town. There he had a practical training, which gave added value to the thorough scientific training he enjoyed at the University of St. Andrews. At the end of five years, Mr. MacPherson secured the position of Manager to the Stranraer Gas Company; and this he retained for three years, during which time he gave complete satisfaction to the Board. He then, however, left to take up what proved to be the principal work of his life at Kirkcaldy—being selected for the position of Gas Engineer and Manager there.

Mr. MacPherson was, as a matter of fact, in the service of the Kirkcaldy Gas Company as Engineer and Manager for the long period of 34½ years; having been appointed in 1869, and retiring in 1903, owing to ill-health. Subsequently, he was appointed a Director of the Company; and in 1910, after the death of Mr. Davidson [who up to that time occupied the chair], he was made Chairman. During his engineership of the Company, Mr. MacPherson almost entirely re-constructed the gas-works—bringing the plant up to date, and carrying out various large extensions necessitated by the increasing demand for gas. He was, it is said, one of the first Scotch gas engineers to adapt the regenerative system to retort-settings. He, of course, took an active part in the proceedings which led up to the transfer of the undertaking to the town.

He read various papers before the North British Association; and when, on two occasions, there were competitions for the best essays on certain subjects, Mr. MacPherson was each time awarded the prize. In addition to his work at Kirkcaldy, he was also engaged a good deal as a Consulting Engineer to other gas undertakings. Thus he led a busy life, of great usefulness to the industry with which he was connected.

## OBITUARY.

Mr. John G. Lyon, head of Stainsby and Lyon, Limited, of the Aire Tar-Works, Knottingley, died at Pontefract last Friday week, at the age of 73.

The death is announced, as having taken place in the later weeks of last month, of Mr. Arthur W. Sharples (aged 47), of Oswaldtwistle, Lancs., the Secretary of Messrs. W. Metcalf, with which firm he had been associated for many years.

The "Journal für Gasbeleuchtung" of the 21st ult. gave particulars of the life-work of Herr Max Hempel, who died on June 10, within a few days of his 66th birthday. Born in Silesia, Herr Hempel spent a year in a London engineering works, which he left to serve in the Franco-Prussian war of 1870-71. He was then for ten years with the firm of Oechelhaeuser. In 1880-81, he was engaged on the construction of the No. III. gas-works at Breslau; and on their completion, he was appointed Works Manager—a position he held for six years. In 1886, he joined Herr Joseph Goetz in founding a constructional engineering works, of which in 1891 he became sole proprietor. This works, trading as the firm of "M. Hempel," of Westend, Berlin, has carried out in the past twenty-five years a great deal of constructional iron work on gas and water works in Germany.

## PERSONAL.

The Leeds Corporation Gas Committee have appointed Mr. C. P. Tooley, Superintendent of the carburetted water-gas plant at the Meadow Lane works, to the vacant position of Assistant Manager at the New Wortley works.

Second-Lieutenant W. C. Nesbit, of the 6th Royal Dublin Fusiliers, reported from the Dardanelles as wounded and missing, was Chief Cashier of the Alliance and Dublin Consumers' Gas Company, and obtained his commission in December last.

Captain W. C. Church, 4th Battalion Essex Regiment (T.F.), was, we regret to learn, wounded during operations in the Dardanelles on the 21st ult. The injured officer, who was educated at Hurstpierpoint and Felsted, is the son of Mr. Worthington Church.

Mr. W. J. Liberty (Inspector of Public Lighting of the City of London), the Chief Petty Officer, R.N.A.S., H.M.S. "President," Foreign Service Section, Caterham, has been promoted to the Admiralty Board of Inventions and Research (Lord Fisher's new department).

We understand that the question of the appointment of a successor to Mr. W. D. Child as Engineer of the Romford Gas Company has not yet been decided. The Directors have, however, appointed Mr. C. W. Boyns to be Manager of the Company, in addition to his duties as Secretary.

Mr. John W. Lee, the President of the Yorkshire Junior Gas Association, late of the Sheffield United Gaslight Company, and for the past four years Chief Chemist to the Grassmoor Company, of Chesterfield, has been appointed Manager of their coke-ovens and bye-product plant. Mr. Lee is lecturer in "Gas Engineering" at the Sheffield University.

Last Thursday week the golden wedding was celebrated of Mr. and Mrs. Samuel Shepherd, of Springfield House, Guiseley. Mr. Shepherd has for long been connected with the Yeadon and Guiseley Gas Company and the Guiseley Water-Works Company; and, among the presents received, was a combined silver fruit dish and flower vase from the Directors of the former concern, and a silver flower vase from the latter Company.

After considering forty applications for the position of Gas Manager, the Gas Sub-Committee of the Biddulph Urban District Council reduced the number to two; and these candidates were interviewed by the full Gas Committee. As a result, they recommended the appointment of Mr. G. Hood, at a remuneration of 35s. per week, with house, rates, fire, and light; and this the Council have adopted. Mr. Hood is at present fitter and assistant at the works.

Referring to the late Mr. William Blakey, Chief Accountant to the Gas Light and Coke Company, whose death was recorded in the "Journal" a fortnight ago, the "Co-Partners' Magazine" remarks that he laboured wholeheartedly at the many details of the co-partnership scheme before its initiation, and was always interested in its operation. "His memorial is that of a most competent and painstaking officer and a very courteous and helpful friend of all those, and they were many, who sought his aid."

In the course of a letter to Mr. J. F. Braidwood, thanking the officers of the South Metropolitan Gas Company for their address and handsome presentation of silver on his retirement from the Chief Engineership, Mr. W. Doig Gibb asks that there may be conveyed to them his warm thanks for all their goodness—in thought, and word, and deed. The gifts, he says, will ever stand as a record of the good feeling between himself and the staff of the Company. "When I came among you," concludes Mr. Doig Gibb, "my declared policy was to do to others as I would that others do to me. However imperfectly I carried out this doctrine in my actual life, I still hope that, notwithstanding my all-too-premature breakdown, the seed which has been sown, and which has germinated, may continue to grow and grow. And, in these strenuous times, when the future of our nation is the greatest consideration with every thinking man, such a doctrine loyally lived up to will result in many a South Metropolitan official and workman being able to say at the end that he has done 'his bit'—he has left two blades of grass growing where only one grew before."

## EXAMINATION PRIZE WINNERS.

From Mr. Arthur L. Griffith, the Secretary of the Society of British Gas Industries, we learn that the following are the winners of the prizes given by the Society in the City and Guilds of London Institute's recent examinations in "Gas Engineering" and "Gas Supply" (Honours Grade):

"Gas Engineering."

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| *First Prize, Final Examination*, £3 3s. | Leonard Howard Thomas, of 9, Chattaway Street, Nechells, Birmingham. Examined at the Birmingham Municipal Technical School. |
| *Second Prize, Final Examination*, £2 2s. | Wilfrid Baker Claridge, of the Gas-Works, Harpenden, Herts. Examined at the Regent Street Polytechnic, W. |

"Gas Supply."

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| *First Prize, Final Examination*, £3 3s. | John Tattersall Haynes, of 72, Athol Street, Liverpool. Examined at the Liverpool Central Municipal Technical School. |
| *Second Prize, Final Examination*, equal. £1 1s. each. | Albert Harry Manning, of 32, Tooker Road, Rotherham. Examined at the Manchester Municipal School of Technology. |
| | Leonard Howard Thomas, of 9, Chattaway Street, Nechells, Birmingham. Examined at the Birmingham Municipal Technical School. |

**Gas Light and Coke Company's Success at San Francisco.**—The preliminary list of awards at the Panama-Pacific Exposition, San Francisco, which has been announced, shows that the Products Works of the Gas Light and Coke Company have added to their numerous previous successes by securing the Grand Prix. The Company's excellently arranged exhibit includes the principal products obtained in the carbonization of coal for gas manufacture, and many of their characteristic derivatives. These products are, of course, treated at the Company's works at Beckton, which are the largest of their kind in the world. The display is divided into three sections of products—tar, ammonia, and cyanogen; and some typical coal-tar colours are shown in dilute solution.

# GAS ACTS FOR 1915.

[Second Article.]

In last week's issue, the essential changes made during this parliamentary session in the gas measures promoted by statutory gas companies were noted; and to-day the points of variation between the gas clauses of the Bills and Acts of local authorities are dealt with. The Bills in this group were reviewed on Jan. 12 (p. 74), and attention will only be called now to the differences developed during the progress through Parliament.

The Chelmsford Corporation have secured the powers, in pursuance of the purchase clause in the Gas Company's Act of 1914, to enable them to acquire the undertaking of the Company. There is comparatively little change from the Bill as introduced. We see among the conditions applying to the payment of the purchase money that, in the event of the Treasury refusing their consent to the borrowing by the Company of the purchase money, the Company are not to be entitled to require the Corporation to pay the money until one month after such consent is given, or the necessity for such consent ceases, whichever is the earlier. A proviso appears to the effect that, if the Corporation do not pay the purchase money on the date of the consent, they are to pay the Company interest on it at the rate of 10 per cent. per annum from the date of consent to payment. The limits of supply are specifically defined; and it is observed that it has now been enacted that if, after the expiration of nine years from the passing of the Act, the Corporation have not laid mains for the supply of gas within any parish within the limits of supply, the Act shall not be deemed to prevent any company, person, or local authority obtaining the necessary statutory power from supplying gas to any of the parishes. In Chelmsford, and the parishes of Springfield, Broomfield, Great Baddow, and Widford, the price of gas is not to exceed 3s. 9d. per 1000 cubic feet; and in other parts of the area, the price is not to exceed by more than 9d. the price for the time being charged in Chelmsford. The people of the four parishes named above are resolved that they shall be on the same terms as those in the borough. They have caused the insertion of a provision to the effect that the price charged to the ordinary consumers in these parishes is not at any time to exceed the price charged to persons who burn gas through ordinary meters in the borough. In protective clauses in favour of the Rural District Council of Chelmsford, provision is made where pipes are hereafter laid or relaid for them being placed, wherever practicable, so that the top of the pipe is not less than 2 feet below the surface of the roadway. This, of course, does not apply to pipes laid under footpaths or greensward. The financial clauses have undergone amendment. The provision stands conferring such power as is necessary for providing the money for the purchase of the concern, for compensation, and for the expenses attendant upon the winding-up of the Company. For other purposes, £60,000 was asked for in the Bill; and the repayment period desired for the purchase money and loans raised was 35 years. This period has been allowed for the purchase money. What has happened in regard to the £60,000 is that power has been given to raise £36,000 for the erection, alteration, and improvement of the gas-works; the repayment period being forty years. A sum of £13,200 has been granted for new mains and the extension and improvement of mains; the repayment period being thirty years. An amount of £10,800 has been granted for new services, meters, stoves, and fittings; the repayment period for this being fifteen years. As already intimated, the Corporation are debarred from borrowing money (other than the money required for defraying the costs, charges, and expenses of the Act, and of opposing the Bill for the Act of 1914) during the continuance of the war and twelve months thereafter, unless the consent of the Treasury has been previously obtained. There are no other changes to record. [*Parliamentary Agents: Messrs. Hargreaves and Crowthers.*]

In the section of their Act asking for an extension of the limits of gas supply to Emley, Flockton, and Whitley Upper, the Dewsbury Corporation have had it enacted that all mains, pipes, and works laid down or executed by the Corporation before the passing of the Act for the purpose of supplying the areas named shall, for all purposes (including the borrowing of money), be deemed to have been laid down and executed under the powers of this Act. Regarding the price of gas, as from the expiration of any agreement made before the passing of the Act between the Corporation and the Council of any of the districts named, or as from the expiration of a period of ten years from June 30, 1915 (whichever shall be the earlier), the prices charged in that district are not to exceed the prices charged under similar circumstances for a corresponding supply in the borough by more than 8d. per 1000 cubic feet in Emley, 6d. in Flockton, and 4d. in Whitley Upper. In the Bill, the Corporation, in proposing the cancellation of the illuminating power standard, asked for a calorific value standard of 540 B.Th.U. on the model clause lines. The 540 has been altered to the very common prescription this session of 500 B.Th.U., without a margin. The Corporation are given the power to purchase crude or partially purified gas. A clause provides that section 50 [Application of Gas Revenue] of the Act of 1873 shall be read and have effect as if the district fund and general district rate were therein mentioned, instead of the borough fund and the borough rates leviable by the Corporation; and further that any deficiency in the revenue of the Corporation on account of the gas undertaking which is not made good out of their contingency or depreciation fund shall be made good out of the district fund,

> Provided that the total amount payable by a railway company in respect of the borough rate, and of the general district rate shall be the same as if this section had not been enacted, and as if any sum which the Corporation shall, in pursuance of this section, carry to the district fund had been carried to the borough fund, and applied in the manner authorized by the said section 50.

There are no other changes to record. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Doncaster Corporation have secured the gas-works lands powers which they sought; and a piece of land is scheduled for manufacturing purposes. The proposed extension of the limits of supply has been endorsed. The model calorific value standard displants the illuminating power one. Authorization is conferred to purchase gas in bulk in a crude or partially purified state. For gas-works purposes, the Corporation asked in the Bill for the right to borrow £65,000, with forty years as the period of repayment. The outcome of this request is that a sum of £53,000 has been allowed (with thirty years for repayment) for the erection of gas-works and the general purposes of the undertaking, other than meters; and for meters £10,000, with a ten years' repayment period. As in most other Acts, it is provided that nothing in the Act shall exempt the Corporation or the gas undertaking from the provisions of General Acts relating to gas supply which may be passed in this or any future session of Parliament. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

In the Lincoln Corporation Act, the parish of Bracebridge Heath appears to have been removed from the scheme for the extension of the area of supply, but North Hykeham and Waddington remain. The other gas clauses are of normal character. The Great Northern Railway Company and the Great Eastern Railway Company and the Joint Committee of these Companies have secured protection. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The terms (stated when noticing the Bill on Jan. 12 last) on which the Lurgan Gas Light and Chemical Company are parting with their works to the District Council are confirmed in the Act promoted by the latter. We see, in the clause providing for the continuance and maintenance of the gas-works, that the residuals powers are as the model, but without any restriction—a proper restoration of liberty which was the subject of comment in our editorial columns last week when dealing with Statutory Gas Companies Acts. Protective clauses are accorded the Down County Council. Following the clause defining the limits of supply, provision is made for the sale of the plant in outside districts if the local authorities desire to purchase. The maximum price of gas has been placed at 4s. 6d. instead of 4s. 3d. per 1000 feet. The calorific power standard is the level one of 500 B.Th.U. There has been no change in the other matters noticed when reviewing the Bill. [*Parliamentary Agents: Messrs. Lees and Co.*]

In the gas section (referring to Devonport) of the voluminous Act of the Plymouth Corporation, we do not find any departure from the indication given as to the nature of the clauses when reviewing them on Jan. 12, except in one particular. The Corporation then asked to have conferred on them the right to "manufacture, purchase, sell, supply, and deal in" residual products; but the Act contains the model residuals clause *in toto*—that is to say, including the restriction as to liberty to purchase from other gas undertakings only up to the equivalent of one-third of the buying undertaking's own production. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The General Powers Act of the Rhondda District Council contains the one or two provisions referring to gas supply as noted in the review of the Bill; but it is observed that the proposal, among the miscellaneous clauses, as to sanction being conferred to make contributions to funds of associations of local authorities or of their officers, and to defray reasonable expenses incurred in attendances at conferences, has disappeared. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

The Skegness District Council Gas-Works Purchase Act shows little change from the Bill as originally deposited, and as reviewed in the "Journal" for Jan. 12. Among the conditions is the one that if the Treasury "refuse their consent to the borrowing by the Council of the money required for paying the purchase money, the Company shall not be entitled to require the Council to pay the purchase money until such consent is given or the necessity for such consent ceases." In connection with the power to maintain gas-works, the model provision as to residual products, with the one-third restriction, has here been inserted. The maximum price of gas has been altered from 3s. 6d. to 4s. 3d. The financial powers have been changed somewhat. The Corporation have the power to raise the money required for the purchase, with a repayment period of thirty-five years (instead of forty years, as desired); the sum needed to discharge any debentures, mortgages, obligations, and liabilities has also a repayment period of thirty-five years attached; a sum of £5000 is authorized in relation to the laying of mains and other works for the distribution of gas, with a repayment period of thirty years; the proposal as to working capital has disappeared; but provision is made for paying the costs of the Act and of the Company's Act of 1914, and for raising further money with the approval of the Local Government Board. [*Parliamentary Agents: Messrs. Baker and Sons.*]

In the Act obtained by the Sunderland Corporation for the reconstruction of Wearmouth Bridge, they have power to interfere

with gas and water mains and pipes; but both the Sunderland Gas Company and the Sunderland and South Shields Water-Works Company have obtained protective clauses. In the clauses referring to the gas-mains, it is provided that the Corporation shall provide accommodation on one side or both sides of the bridge, and on or under the approaches thereto, or in such other convenient position as may be agreed between the Corporation and the Gas Company for substituted apparatus and for an additional steel main of 8 inches internal diameter for conveying compressed gas; also provide (before interfering with any existing apparatus) substituted apparatus, to the reasonable satisfaction of the Engineer to the Company, comprising two mains each of 18 inches internal diameter with the necessary valves and expansion pipes. All expenses incurred in providing the accommodation, and in laying down the mains of 18 inches diameter, and in altering, diverting, or stopping up any apparatus between specified points are to be paid by the Corporation. But all expenses incurred in the provision of mains, valves, and pipes, and in laying down the additional steel main for compressed gas and the apparatus in connection therewith, are to be paid by the Company. The Company are also to pay to the Corporation £25 per annum; the first payment to be made as soon as the substituted apparatus shall have been provided. In connection with the water-mains, the Corporation are to provide, before interfering with any of the existing apparatus, two mains each of 12 inches internal diameter, with the necessary valves and expansion pipes, to the reasonable satisfaction of the Engineer to the Water Company. The bridge, it may be mentioned, is to have a span of not less than 296 feet. Without the amount required for land, &c., the Corporation are empowered to borrow a sum of £144,000 for the constructional work. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

## ELECTRICITY SUPPLY MEMORANDA.

THE quality and efficiency of local government depend largely on the mental capacity of the men composing the (as the case may be) borough or district council. Where the capacity is of an inferior order, there efficiency is never found; and the lot of the officials is, as a rule, anything but an enviable one. The chief officials of gas undertakings know this.

**The Unhappy Central Station Engineer.**

There are some municipal gas men whose official existence is quite a happy one, and who are encouraged, by rational treatment, to do the best that human energy and the extent of the brain power with which they have been endowed will permit. The opposite is also unfortunately true. Electrical engineers have consonant experience. An "Engineering Correspondent" in the "Times Engineering Supplement" refers to the "unhappy" conflicts that take place between central station engineers and their committees or, as a variation, between the former and the consulting engineers appointed by the latter. The text on which the writer expounds his views is "Qualifications for Municipal Work: Tact and Technique." The three main qualifications, in the order of comparative value, which he says the central station engineer requires, are: (1) Diplomatic tact in his relations with the Committee; (2) business sense in his dealings with the consumers; (3) technical skill in the management of the undertaking. The specification is excellent; and while the qualifications are desirable under any set of circumstances, they are not infallible against the formidable pig-headedness and conceit of some of the men who, by the aid of the only thing of which they are possessed—a windy verbosity—are placed in the seats of the local mighty, and there work with a really despotic hand. These are the men, points out "Engineering Correspondent," who, after an engineer has devoted months to perfecting (say) the plans for an extension scheme, reject them, or adopt them in part, or make the engineer feel that complete reliance is not placed on his technical capacity and judgment by calling in a consulting engineer to examine into his proposals. Under such circumstances, all the "Times" writer can offer in the way of counsel is that the central station engineer must give ceaseless attention to the idiosyncrasies and prejudices of these men. Further, he must not neglect to be their elementary schoolmaster in electrical technics and economics; otherwise it commonly happens that some of them will search for knowledge among shift engineers, manufacturers' salesmen, or consulting engineers, and will form obstinate opinions of their own. All this advice is no doubt good, but is not a compliment to the position of the professional engineer (official though he be), or to the manner and methods of some of our local governors.

**Training, Position, and the Man.**

"Engineering Correspondent" then leads his readers to the threshold of the place where there can and will be eternal discussion as to the best equipment required by an engineer and general manager of an undertaking—such as an electricity supply one. Of course, he considers the matter almost exclusively from the point of view of the municipal engineer; because, relatively speaking—contrary to the conditions in the gas industry—only few electricity supply undertakings are company controlled. However, the described melancholy conditions with which a central station engineer is environed are not what one should expect after a fond parent or a conscientious guardian has spent hundreds of pounds on technical education and adolescent maintenance. From the outset, the young professional is offered a salary less than the equivalent of a trade unionist's rate of wages, and promotion is slow and uncertain. The "Times" writer does not make any suggestions as to how the conditions can be altered. All he proposes is diplomacy, which, in the circumstances, means the insulting of professional position and the bending of manhood, in order that the local bigwigs may feel their own importance and supremacy. This may be tactful; it may be diplomatic. But it does not remove the defects under which local government is carried on to-day, largely through the composition, and indifferent capability of some of the units, of the ruling body. The policy which makes professional training and status subservient to the petty ambitions and conceit of local councillors is not the way to raise the level of the professional man in the municipal world, make his indispensability more keenly recognized, and place him in the position to command adequate remuneration. However, the discussion of the matter by "Engineering Correspondent," which does nothing more than keep us in the same old *cul de sac*, leads him to remark on the type of man best suited to professional work in the electricity industry. He says: "Such technical knowledge and skill as can be bought from the professor and the foreman fetch but a low price when offered in the market for resale. It is the original bent that secures higher valuation, or the practical and sensible opportunism that enables the young engineer to make the most of his market by diplomacy and business push. It will be found that the men who achieve most material success in electrical service, whether as chief engineers of supply undertakings, or as consultants, or as officers of manufacturing companies, possess technical knowledge that is broad rather than deep—for depth can come only by specialization—and that it is their general energy and intelligence that have won them their eminence." There is much truth in the lines quoted, which are some of the best in the article.

**Efficiency of Direct and Semi-Indirect Lighting.**

In last week's "Memoranda," reference was made to the first of two articles in the "Electrical Review," on the subject of electric-lamp developments, by Mr. L. Crouch. In the second article, he points to the fact that the high intrinsic brilliancy of the metal filament, and particularly the so-called "half-watt," lamp makes concealed or indirect systems essential for interiors. We have frequently pointed to the absurdity, when using these systems, of calculating current expenditure per candle power on the manufacturers' estimate of the efficiency of the naked lamp. Mr. Crouch emphasizes this when, alluding to the Moore lamp, he remarks: "On the plain basis of watts per candle, it is not an efficient lamp, but, allowing for all losses, an overall consumption of 1·6 to 1·7 watts per candle power is obtainable; and *this compares very favourably with the corresponding overall efficiency of most direct* [? indirect] *and semi-direct systems* using high efficiency lamps." In other words, while the efficiency in the case of a "half-watt" lamp is stated as 1 candle per ½ watt (truth puts it nearer 0·75 watt), it is only, when used with indirect or semi-indirect fittings, 1 candle per 1·6 to 1·7 watts. This, therefore, is the efficiency on which, under such conditions, calculations should be made. Incidentally, Mr. Crouch pronounces against the extraordinary uniformity of illumination and absence of shadow produced by indirect systems; his experience being that most people appear to be more or less depressingly affected from entirely indirect lighting, and have a sense of being confined and "on show." Perfect uniformity of lighting is not natural; it is essentially artificial.

**Hospitals and Electrical Failures.**

It is generally known that quite a large number of electrically lighted places to which the public resort have a stand-by system of gas lighting. Some hospitals and infirmaries, also electrically lighted, where there has been unpleasant experience through the collapse of "fickle electricity" supply at an inopportune time, have likewise stand-by systems. And it is highly necessary they should have. To have a collapse of lighting during a critical operation may mean the death of a patient. The "Lancet" recently called attention to a case of an electric lighting collapse during an operation; and "Electrical Industries" comments on it. During one of the air-raids on the East Coast, a well-known surgeon was performing the operation of tracheotomy at a nursing-home, when, through the appearance of enemy aircraft, the current was switched-off at the main. At the moment, the surgeon was busy at a most critical part of the operation—that of opening the windpipe. Fortunately oil-lamps were kept in readiness in the institution for any sudden failure of the electric current. "Electrical Industries" admits that there may be hundreds of hospitals and nursing-homes where a sudden failure of the light might occur any night "not only from Zeppelin causes, but by an accident at the station or to the mains." It is thought that the situation gives electrical contractors a first-rate chance to push the claims of an auxiliary lighting service from storage batteries. It has also been found that failures of electricity supply have been excellent opportunities for pushing the claims of gas lighting; and this has been done with good effect. Even oil-lamps afford greater reliability, and are much cheaper, than a sufficient installation of electric storage batteries. More-

over, one never really knows what is going to be the duration of an electrical failure.

**Electric Cooking in Hotels, &c.**

The "Electrical Times" would be glad to hear from anyone who knows of hotels in this country in which electricity is the sole cooking agency. Not even by the exhilarating aid of "the spur of the moment," can our contemporary call to mind any hotel in such a "happy" position, although it asserts there are several on the Continent and in the United States. However, our contemporary points to a number of restaurants and institutions which, it declares, depend "exclusively" upon electric cooking. These are: The B. and K. Restaurant, Earl's Court Road; the Tricity House, Oxford Street; the Regent Street Polytechnic; the Bradford Corporation Kursaal; the Pavilion, Torquay; the Blackpool Tower; the Cavendish Restaurant and Whitehall Café, Derby; the Orleans Club, St. James's; and "several" others. Now is it true to say that all these places depend "exclusively" upon electricity for "cooking?" Our contemporary does not state how many of them are purely advertisements, and how many of the "others" are under direct electrical patronage, and almost daily the solicitous care of the local electrical staff. Then the story proceeds: There are many staff kitchens attached to large business houses in which electricity is employed "throughout" for cooking. It would be very interesting if our contemporary would check the word "throughout" in relation to some of the establishments referred to. Among institutions, it says, may be mentioned: Park Prewett Asylum, Hampshire; the Fever Hospital, Derby; the Empire Hospital, Westminster; a large hospital at Sheffield; a large institution at Leatherhead; and a "number" of nursing homes in London and the Provinces. The Old Ship Hotel, Brighton, "depends mainly" upon electricity. Does it? As will the Brighton Pavilion when it resumes its normal *rôle* of furnishing banquets, instead of accommodating wounded Indian troops; while many other hotels, restaurants, boarding-houses, and nursing homes are actually installing electric cooking apparatus to supersede gas and coal, or are about to do so. It is all wonderful and nicely put—from the electrical point of view. But there are other sides to the tale.

**Fires at Electricity Stations.**

The "Electrical Times" says there have lately been an uncomfortably large crop of fire outbreaks at electricity stations. There was the recent one at Ebbw Vale, when the power station was gutted, the district deprived of current, and nearly 10,000 men thrown out of employment. Other reports of fires at electricity stations have recently come along; and our contemporary is "tempted to think very furiously of such events." In its opinion, it is an immense pity that guards are not provided for electricity stations from the regular and volunteer forces. Why do not the electricity stations provide their own sentries the same as many gas undertakings have done. However, guards from the national and volunteer forces could not have prevented lightning, causing (as it did on the 16th ult.) a fire at the Ipswich power station, and blowing fuses in the distributing mains. There was not much damage done to the electrical station; but the lightning striking the tramway trolley wires affected the automatic switches at the station. In the eastern district, current was cut-off from some of the consumers. An overhead electrical cable supplying power to a workshop was brought down. At the Ranelagh works of Messrs. Reavell and Co., the machinery is run by electricity, and the fuses were blown, putting practically all the machinery out of action. Through the blowing of fuses, the electric power was also cut-off at the St. George's Motor Works. Nor could a blaze, on the 22nd ult., at the Belfast Corporation Electricity Works have been prevented by guards from the regular or volunteer forces. This fire was attributed to the spontaneous combustion of coal. The conflagration was very fierce; but the fire was kept from the main engine room and plant. About 2 a.m. some boiler hands found that one circuit of the local electric lighting had broken down; and this led to the further discovery that spontaneous coal combustion was in full swing. It is strange that the spontaneous combustion of the coal was not discovered before it had got such a hold that it set the roof woodwork alight. Spontaneous combustion of coal is not something that develops "full swing" all at once. It is interesting to learn that the "Electrical Times" thinks that if sentries had been patrolling the various frontages, they would have noticed the fire; for the "burning roof must have been conspicuous from outside long before the stokers became aware of it from within." Let it stand at that; only readers will understand the statement emanates from the "Electrical Times."

## Manchester and District Junior Gas Association.

In a joint circular letter to the members, the President (Mr. S. Carter) and the Hon. Secretary (Mr. J. Bridge) of the Manchester and District Junior Gas Association, say the Council much regret that they find it impossible to make satisfactory arrangements for the current session, and the following resolution was passed at the last meeting: "Resolved that the proceedings of the Association be suspended for the duration of the war; that the officers recently elected retain their position; and that the Council meet and arrange for meetings, &c., as soon as more peaceful times prevail." It is proposed not to solicit subscriptions until the meetings are resumed.

# UNIVERSAL CALORIFIC STANDARD FOR CANADA.

### A Marginless 520 B.Th.U. Standard Adopted.

Through the courtesy of Mr. Ormond Higman, Chief Engineer of the Department of Inland Revenue, we are enabled to publish an Order in Council—passed under the provisions of Section 1 (sub-section *c*) of the Gas Inspection Amendment Act, 1910, and dated June 26, 1915—establishing a calorific standard for the determination of the heating value of manufactured gas throughout the Dominion of Canada. Mr. Higman writes from the Electrical Standards Laboratory, Ottawa, under date of Aug. 19. The following are the

REGULATIONS.

These regulations are to be construed as subject in all respects to the provisions of the Act; and the several words, terms, and expressions to which by the Act meanings are assigned shall have herein the same respective meanings.

1.—British thermal unit (B.Th.U.) means the quantity of heat required to raise the temperature of 1 lb. avoirdupois of water from 60° to 61° Fahr.

2.—There shall be provided and maintained in proper working order by the department at each departmental testing-place suitable apparatus for testing the calorific power of manufactured gas supplied at such testing-place, and such apparatus, and the method of making the test, shall be such as shall from time to time be determined by the Minister.

3.—The following provisions shall apply with respect to the testings of calorific power made with the apparatus and at the test-places provided in accordance with the requirements of the preceding section:

(*a*) Any inspector of gas appointed under the Act may, by means of the apparatus provided as aforesaid, test at the prescribed testing-place, at any reasonable hour, the calorific power of the gas supplied at such testing-place; but not more than one testing for calorific power shall be made on any one day except in the event mentioned in sub-section (*f*) of this section.

(*b*) The undertaker may, if he so desires, on any occasion of the testing of the gas under the provisions of this section be present, either in person or represented by some officer whom he may appoint. Such representative, however, shall not interfere with the testing.

(*c*) The calorimeter shall be so used as to yield the total heat which shall be developed by the complete combustion in moist (saturated) air of moist (saturated) gas; and the products of combustion shall leave the calorimeter at approximately the temperature of the inlet water.

(*d*) Subject to the provisions of the next preceding sub-section, the testing shall be made in the manner and under the conditions for the time being prescribed by the Minister.

(*e*) The result obtained by means of such testing shall be expressed in terms of British thermal units per cubic foot of gas, and shall be corrected for a temperature of 60° Fahr. and a pressure balanced by a column of 30 inches of mercury at the same temperature. The corrected result shall be the calorific power of the gas determined by the testing.

(*f*) In the event of the calorific power, on any testing, being found to be below the standard calorific power, the undertaker shall be immediately notified in writing, and a second test shall be made on the same day, but at an interval of not less than one hour from the time of serving the notice on the undertaker; and the average of the two testings shall be the calorific power of the gas on that day.

(*g*) Any party may, at any reasonable time, after depositing the fee, demand a test of the calorific power of the gas supply. In the event of the calorific power determined by the test being below the standard, the cost of the test shall be paid by the undertaker; if at or above the standard, by the party demanding the test.

(*h*) The Inspector shall, not later than the day following that on which any testing has been made under this section, make and cause to be delivered to the undertaker a report of the result of his testing, and such report shall be received as *brimâ facie* evidence of the facts therein contained.

THE STANDARD OF CALORIFIC POWER.

4.—The standard calorific power of the gas supplied by the undertaker at the prescribed testing-place shall be 520 B.Th.U. per cubic foot of saturated gas when burned in saturated air and the volume of gas corrected for a temperature of 60° Fahr. and a pressure balanced by a column of 30 inches of mercury at the same temperature.

Provided that the undertaker shall not be liable for more than one penalty in respect of a deficiency of calorific power of the gas at any testing-place on any one day.

PENALTIES FOR DEFICIENCY OF CALORIFIC POWER.

5.—If on any day the calorific power of the gas tested in accordance with the provisions of these regulations is below the standard calorific power prescribed, the undertaker shall be liable to the following penalties:

(*a*) Companies having over ten thousand (10,000) meters, $80

for the first offence, and double this penalty for each subsequent offence.

(*b*) Companies having five thousand and one to ten thousand (5001 to 10,000) meters, $60 for the first offence, and double this penalty for every subsequent offence.

(*c*) Companies having two thousand and one to five thousand (2001 to 5000) meters, $40 for the first offence, and double this penalty for every subsequent offence.

(*d*) Companies having one thousand and one to two thousand (1001 to 2000) meters, $20 for the first offence, and double this penalty for every subsequent offence.

(*e*) Companies having one thousand (1000) meters and under, $10 for the first offence, and double this penalty for every subsequent offence.

SAVING CLAUSE AS TO PENALTIES.

6.—Notwithstanding anything contained in these regulations, no penalty shall be incurred by the undertaker for any deficiency in calorific power in the gas tested in accordance with the provisions herein contained in respect of which the Inspector reports, or it is proved, that such deficiency was produced by any circumstance beyond the control of the undertaker. Provided that want of sufficient funds shall not be held to be a circumstance beyond the control of the undertaker.

PROCEDURE.

7.—All penalties imposed under the authority of these regulations shall be recoverable on summary conviction in accordance with the provisions of section 62, 63, and 65 of the Gas Inspection Act, Chapter 87 R.S.

8.—These regulations shall come into force and be operative from and after the 1st day of July, 1915.

9.—All previous Orders in Council and regulations relating to the testing of the illuminating power of gas and in respect of sulphur and ammonia tests are hereby repealed.

J. U. VINCENT, Deputy-Minister.

ORMOND HIGMAN, Chief Engineer.

[This Order is referred to in our editorial columns.—ED. J.G.L.]

## COKING AND BYE-PRODUCTS.

**By "Event and Comment."**

SCIENCE, INDUSTRY, AND BYE-PRODUCT COKING.

THE forthcoming meeting of the British Association will be held this year at Manchester under exceptional circumstances; and now that we have had a full year of war in which to enable us to realize to some extent the amount we were dependent on German science and German industry, we may surely expect that the addresses at the meeting will give full vent to British scientific opinion on these matters. It is evident enough that our dependence on Germany is not due in any way to superior scientific traits of the German people, but rather to the superior organization of their scientific resources, and a proper regard for the relationship which should exist between science and industry.

If there is any outstanding point for regret in connection with the character of the British Association meetings, it is that sufficient is not seen of the scientific men who are associated with the practical side of industry. There are, of course, departments in connection with our higher education system which pretend to give a practical insight into various industries. In some cases they have been successful but in others they have been a distinct failure, and in the latter—in the writer's opinion—the cause of the failure is almost invariably the fact that the head of affairs is a man who is lamentably lacking in practical experience. There seems to be an idea in the minds of those who are responsible for the appointment of such men that there are no suitable scientific men in the ranks of practical workers. There appears to be a kind of intellectual contamination about a works which bars the individual concerned from obtaining any high position in the educational world however suitable he may be in other respects. How many professors and lecturers in industrial subjects at our various universities, technical colleges, &c., have any real practical experience? How many of the estimable gentlemen who read learned discourses on technical subjects have ever actually been in charge of the operations they so fulsomely describe? Much of the information contained in the papers is not the record of their own experience, but of some despised practical man; and the account of such experience would come with much more force from the practical man himself.

In view of the fact that bye-product coking is playing such an important part at the present time in supplying munitions of war, and will after the war continue to be an important adjunct to the establishment of the synthetic dye industry in this country, it is not at all unlikely that it will be frequently mentioned during the meeting of the Chemical Section, and in more or less detail. As a general rule at such meetings a vast amount of inaccurate information is disseminated, and many crude suggestions are put forward as to what ought or ought not to be done. If the subject is worth dealing with at all, it is worth being dealt with properly; and the writer would suggest—as with bye-product coking, so also with other sections of industry—that sectional meetings should be arranged, and men intimately connected with individual subjects invited to attend, read papers, and take part in the discussions. Get the practical men on the job—the men who have to face the actualities of the subject every day of their lives. These men, combined with the eminent scientists who are themselves interested in the subject, would be far more likely to evolve something useful than either group alone, and the meeting could then truly call itself the British Association for the Advancement of Science. At present it is too ethereal and almost too impossible from the industrial point of view.

THE RECOVERY OF TOLUOL.

A short time ago some remarks appeared in a leading article in the "Yorkshire Post" on the subject of the recovery of toluol, to the effect that "few coke-making plants in this country are fitted with the apparatus for the recovery of bye-products, and that therefore Great Britain has to depend entirely on the gas-works of the country—all, or nearly all, of which . . . save their toluene." The "JOURNAL" rightly pointed out that the writer of the article had "had a fall." In last week's "JOURNAL" (p. 458), a letter appeared from this gentleman defending his original statement, and citing in evidence a letter by "H. J. H.," which also appeared in the "Yorkshire Post." "H. J. H." quotes figures from the Mines Report of 1914, which state that in 1913 there were working 13,167 beehive ovens and 7839 bye-product ovens; and he leaves it to be implied from this that these numbers represent the proportion of coal carbonized in the two systems. While agreeing that coke-ovens are doing far less than they might and should—as stated in the letter to the "JOURNAL" referred to above—the writer should discriminate between bye-product ovens and beehive ovens. It takes both time and money to build bye-product ovens; and it is safe to say that at the present time bye-product oven people are doing all that is possible to help. Beehive oven people are doing nothing—that is, from the toluene point of view. Contrary to the implication conveyed by the figures given above, calculations show that most probably about 55 per cent. of the total amount of coal carbonized for the production of metallurgical coke is dealt with in bye-product ovens in this country, and the remaining 45 per cent. in beehive or other non-recovery ovens.

The writer of the letter to the "JOURNAL" then goes on to make the following absurd statement:

> If the gas-works are not yet doing all they might in regard to the production of toluol, the coke-ovens as a whole are doing much less.

Let us look at the position fairly for a moment. With the exception of a few of the larger gas-works, the only source of toluene from gas-works is the coal tar.* Modern methods of carbonization—*i.e.*, high heats—are not favourable to the production of a tar especially rich in toluene. Coke-oven conditions are, if anything, the more favourable of the two; but let us call them equal. The tar from one ton of coal produces probably not more than one-fortieth of a gallon of toluol. Let it be assumed that approximately 20 million tons of coal are carbonized per annum at gas-works and 15 million tons at bye-product coke-works. This means that the former will produce 500,000 gallons of toluol and the latter 375,000 gallons. But 80 per cent. of coke-ovens recover crude benzol; and this, at a very modest estimate, yields one-fifth of a gallon of toluol per ton of coal carbonized. Taking, therefore, one-fifth of a gallon for 80 per cent. of 15 million tons of coal, there are obtained as the production from this source 2,400,000 gallons—a total coke-oven production of 2,775,000 gallons—against 500,000 gallons from gas-works. Much, of course, remains to be done on coke-ovens, but on those of the beehive type.

Some correspondents have commented on the fact that there are still a large number of bye-product ovens not recovering benzol. This is quite true; but it must be borne in mind that the majority of such ovens are dealing with low volatile coal, which yields very little benzol—or toluene—at all, and that in these cases it is hardly worth recovering.

* A considerable number of gas-works—medium sized and small, as well as large—are to-day tar washing their gas, and so largely increasing the quantity of toluol in the tar.—ED. J.G.L.

**Gas Manufacture and Cyanide Processes.**—In the course of an article dealing with cyanide processes in last Friday's Engineering Supplement to "The Times," the writer, referring to the indirect advantages of removing cyanide from gas, says that, apart from the fouling of gasholder water, and the possible corrosion of gasholder plates and other apparatus, the removal of the cyanide is strongly to be urged, owing to its effect on the efficiency of the purifying material. It is beyond all question, he continues, that oxide of iron, whether natural or artificial, will remain in active condition for a much greater length of time when the cyanides are absent—so much so that both Bueb and Guillet have shown that in some cases the efficiency of the "dry" purifiers may be increased by 50 per cent. if the compound is extracted. Perthuis, too, has pointed out that in certain circumstances cyanogen is responsible for a reaction—not wholly understood—in purifiers which may cause the material in them actually to increase the sulphur impurities in the gas. On works where no recovery plant for cyanogen is in use, the bulk of the substance will be removed by the oxide or lime purifiers, although some slight reduction will take place during the passage of the gas through the wet purification plant.

# THE MONO-RAIL TELPHER.

## ITS INSTALLATION, CARE, AND MAINTENANCE.

By H. C. Widlake, M.J.Inst..E., of the Plymouth and Stonehouse Gaslight and Coke Company.

(*Continued from p.* 456.)

### Special Branch Track Switch.

An appliance which adds greatly to the adaptability of the mono-rail telpher is the special track switch used by Messrs. Strachan and Henshaw, previous to the introduction of which particular trouble was generally experienced in devising a safe and really reliable method of diverting the telpher machine on to branch tracks from the main line, on account of the difficulty in providing for the smooth running of the machine over the junction, the objection to breaking the main track, and the difficulty of providing for proper continuity of the overhead electrical supply wires, which have, of course, to operate simultaneously with the track switch.

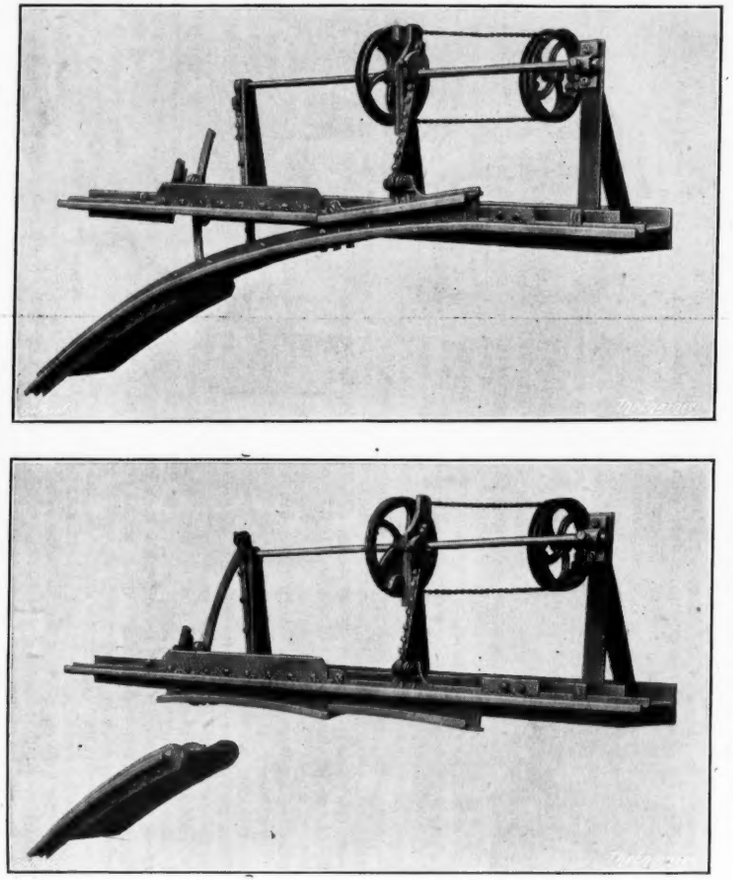


Fig. 3.—Strachan and Henshaw's Branch Track Switch.

By the adoption of this switch, all these difficulties have been successfully overcome. The system is easily applicable to either single, double, or treble overhead trolley systems; while the continuity of the main track joist is not broken or interrupted in any way. The tendency of the track to spring when the main joist is broken is thus avoided, and the rigidity of the track is maintained. No difficulty has been experienced in mating-up the end of the branch rail with the moving rail; and the smooth running of the machine through the junction is assured.

There is nothing elaborate about the switch, which is of simple construction, and the operation is a very simple matter. As may be seen from fig. 3, it is of very substantial construction, and can be operated with ease either from the ground—when it would be provided with an additional locking device so as to prevent unauthorized handling—or by the telpher driver, within whose reach the operating lever can be easily placed. It may be operated instantaneously; while the switch is self-locking in either direction. As stated, the overhead wiring switch operates simultaneously and automatically with the track switch, and a smooth path is provided for the current collectors; so that the switch is negotiated without the occurrence of jerks or arcing.

When it is so desired, provision can be made for the current to be automatically cut off from the branch track when the latter is not in use—a device which has been found of considerable advantage when any work is being carried out on the telpher itself or on its overhead equipment. Many of these switches are already in operation, and are attracting great attention by reason of their usefulness.

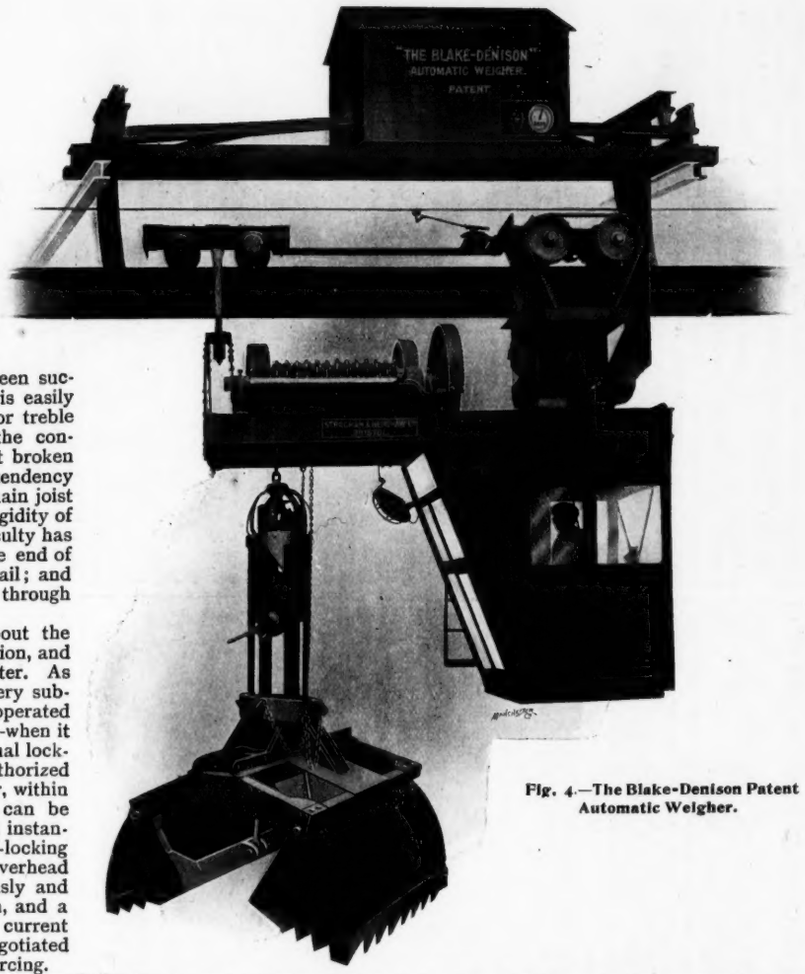



Fig. 4.—The Blake-Denison Patent Automatic Weigher.

### The Automatic Weigher.

Fig. 4 shows the Blake-Denison weigher, which has been in several instances used most successfully in conjunction with telpher installations. The weighing machine mechanism may be placed either on suitable girders above the track or on the ground. The portion of the telpher track to which the weigher is attached is provided with substantial safety stops, and is perfectly free to move vertically for a limited distance, in order to transmit the load to the weigher. Means are also provided for leading the telpher machine smoothly on and off that portion of the track, as also for preventing longitudinal motion of this rail.

The weigher automatically aggregates upon a recorder the net weight of the material carried by the telpher grab or skip; there

being an adjustment on the weigher to balance the tare weight of the machine and its fittings. During the period of weighing, which takes about five seconds, the total weight of the telpher and load is supported by the weighing rail. The machine can proceed on its journey at the expiration of this five seconds; the recording taking about 30 seconds. This is automatically performed by the weigher, which is operated by means of a ½ H.P. motor running continuously. The motor is put into action automatically by the actual weight of the material carried on the suspended track, and stops again on the completion of the cycle. These weighers are guaranteed to weigh accurately to within ½ per cent. of the aggregate loads carried, and are recognized and stamped by the Government Weights and Measures Department.

### Handling Hot Coke.

Telpherage is admittedly not applicable to all retort-houses, on account of structural objections; but the admirable manner in which these installations are dealing with hot coke discharged from the retorts of a large and ever-increasing number of works is making the telpher a serious rival to all other forms of conveyors for this purpose, in respect to both horizontal and vertical installations. Except in cases where the run between the retort-house and the coke storage heap or bunkers is excessive, it will be found that a one-machine installation will deal with the hot coke as quickly as one retort-discharging machine can push it out.

The usual practice is to push hot coke direct from the retorts into lattice bar skips, three or four of which are placed in readiness on the drawing stage in front of the benches. These skips, as they are filled, are lifted and conveyed in rotation from the retort-house to the quenching tank and coke yard; the telpher depositing each empty skip again on the drawing stage in advance of those already there waiting their turn for handling. In this way the machine can do its work continuously without hindrance or loss of time, and so keep up with the charging machine.

It is usual to carry the contents of two retorts in each skip load; but in some works, where the discharges are not too large, the contents of three retorts can be handled at each trip—about 25 to 28 cwt. of hot coke being the maximum quantity that can be conveniently quenched at one time.

After quenching, the coke may be conveyed direct to the coke heap, hoppers, screens, or railway trucks, as desired; the skip being lowered out as far as possible, so as to ensure a minimum fall for the contents. By so operating, it is found that breakage of the coke, and consequent accumulation of breeze, is reduced to a minimum.

The skips are of heavy construction, to stand the varying conditions of temperature and hard usage, and are carefully balanced so as to be self-tipping when full, and to automatically right and lock themselves when empty. The tipping action is controlled by a following cord from the compensating gear fixed in the driver's cabin. The time taken by the cycle of work will, as has been pointed out, depend upon the actual run which the machine has to make to discharge its load, and also, in a lesser degree, upon the height of the hoist from the discharge stage and the quenching tank. The latter, it may be remarked, should be so placed as to reduce the required amount of raising and lowering to a minimum—consistent, of course, with safety as regards the driver's outlook.

The main time factors in the foregoing operation will be: (*a*) Hoisting loaded skip; (*b*) travelling to quenching tank, storage bunkers, and return; (*c*) lowering loaded skip into, and raising from, quenching tank. Assuming a travelling speed of 600 and a hoisting speed of 60 feet per minute, and that the single journey from the retort-house to the storage, *viâ* the quenching tank, is 300 feet, we can time these operations as follows:—

| | Seconds. |
|---|---|
| (*a*) Hoist (say) 25 feet | 25 |
| (*b*) Travelling 600 feet, *plus* allowance for acceleration and slowing up | 80 |
| (*c*) Operations at quenching tank | 30 |
| Allowing say 30 seconds for the other shorter operations | 20 |
| Total | 155 |

From this figure it will be apparent that the machine will handle 20 cwt. (or three retort loads) on a 300 feet run in 155 seconds, or under one minute per retort. The writer's experience with the new two-motor Fiddes-Aldridge machine, built especially for the Plymouth and Stonehouse Gas Company is that a minute per retort is a very fair average performance.

Fig. 5 shows a telpher installation for dealing with hot coke at the Adderley Street Gas-Works of the Birmingham Corporation, from which it will be seen that the skips are so placed as to cover the mouthpieces of two retorts. The installation of a telpher plant certainly conduces to better working conditions in the retort-house, and enables the drawing stage to be kept perfectly dry

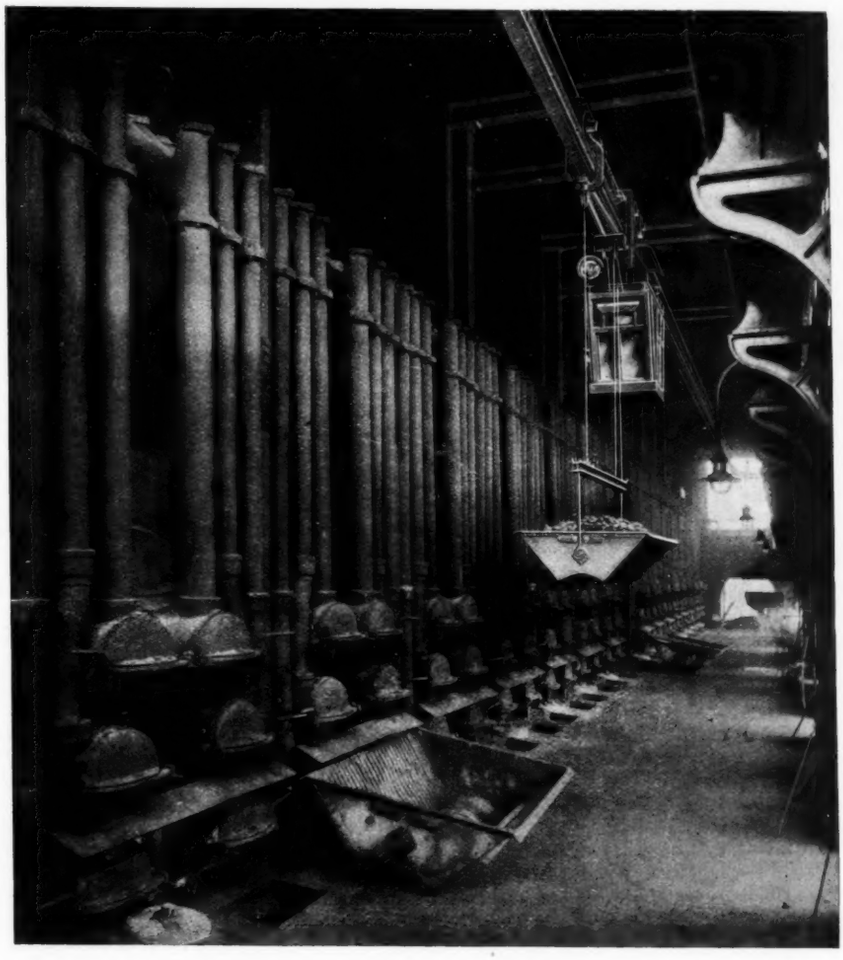


FIG. 5.—THE HOT COKE TELPHER AT THE ADDERLEY STREET, BIRMINGHAM, GAS-WORKS.

and clean; while the small power required for driving and the low maintenance charges render the use of the mono-rail telpher a very attractive proposition. Among the other advantages may be named: (*a*) Breakage of coke reduced to a minimum; (*b*) simplicity of construction and ease of extension; (*c*) all working parts removed from the influence of coke and heat.

### Berthing.

A point often neglected in telpher installations, but one to which too much attention cannot be paid, is the question of providing adequate berthing accommodation. If the plant is situated entirely in the open, the first requirement is, needless to say, efficient protection from the elements. It must be remembered that at times the machine will have to be taken in hand for overhaul or adjustment; and the degree of thoroughness with which work can be carried out will largely depend on the accessibility of the machine and the facilities provided for safe working.

Tackle will have to be rigged, motors slung, and lifted out; and only those who have had to carry out such work hanging on by their eyelashes, so to speak, can really appreciate the benefit of a well-designed berth. The machine should berth alongside a substantial, well-guarded platform on which men can safely stand, tools be laid out, and minor fitting jobs be effected.

The electric supply to the trolley line should be controlled from this platform by means of a double pole switch and fuse, and tappings should be taken from the station side of the switch to provide adequate lighting and to supply two or three plugs, into which hand lamps can be inserted. This arrangement will enable all current to be switched-off the telpher circuits while retaining the use of the power for lighting purposes.

### Trolley Wires.

In the working of a mono-rail telpher upon a direct-current system there are two possible arrangements of the overhead trolley system—namely, the double-pole system and the single-pole system. In the former, two overhead conductors are employed. They are insulated from the running girder and from each other, and deliver and collect current to and from two separate and independent collecting arms fixed on the upper frame of the telpher machine. The single-pole system, on the other hand, is far simpler, and involves the use of only one trolley wire and one trolley on the machine itself.

With the double-pole system the positive bus-bar at the generating station is connected to one of the trolley wires and the negative bus-bar to the other. The current comes from the positive wire into the telpher *viâ* the collecting arm, and, passing through the motor and controller circuits, is returned to the station *viâ* the negative trolley arm and overhead wire. At no point of a properly-maintained double-pole system does the pressure attain "earth" potential, but keeps a certain value above and below this pressure according to the state of the insulation of the wire and the fittings.

With the single-pole system, however, the trolley wire delivers current to the machine *viâ* the one trolley arm, and the current passes through the motor and controller circuits and finally to the frame of the machine itself, to which the electrical equipment of the machine is in this system connected. From the frame of the machine the current finds its way into the running rails *via* the point of contact made by the wheels with the rail on which they run; the rail being connected by a conductor—not necessarily insulated—to the generating station negative bus-bar.

A telpher installation arranged on this system is electrically the same as a street tramway undertaking; but the necessity for electrically bonding the rails does not exist to the same degree as in the street-car system, as if the joints between the rails and the fish-plates are, during erection, kept fairly clean, the cross sectional area offered by these joints for the flow of the comparatively small—in the case of the telpher—return current will be ample to ensure its passing the joints without any appreciable drop of potential. In this connection, however, it must be remembered that an unbonded telpher track will certainly conduce to an objectionable drop of potential provided any electrically poor joints exist; and this will be shown by a diminution in the power available at some particular point of the track, or a dimming of the lights when, in its travel, the machine places such a joint between itself and the source of the power. With a continuous loop-track this trouble is less likely to show itself, and in any case may be regarded as remote.

In any electrical system the occurrence of certain cable faults may result in the setting-up of heavy earth currents—namely, currents which are "straying" and are endeavouring to pick up a path to their ultimate destination by flowing through the ground and through any metallic substance which they may find buried therein. Flowing between two such faults, and in a locality abounding in gas and water pipes, such currents may quite likely prove a source of danger unless provision is made for confining them to well-defined and harmless paths, for which reason alone—and there are many others—it is particularly desirable to maintain one side of the system at earth potential.

Assuming that for the above reasons it is decided to work the telpher on the single-pole system, the portion of the structure on which the telpher running beam rests should be electrically connected to the running beam; and provided it is a steel structure [otherwise the running beam itself should be connected to the return conductor], the point nearest the generating station should be connected to a copper conductor of ample area, carried back through the ground to the generating station and there connected to the negative bus-bar. In no circumstances should a fuse or other circuit-opening device be placed in this return feeder; its object being to maintain the negative bus-bar and the telpher running beam at a harmless and unvarying potential.

On such a system it is usual to connect the negative bus-bar independently to an earth plate of ample capacity, buried in the ground near the switchboard, and connected to the bus-bar through a high-capacity shunt and a low-reading ammeter, for the purpose of detecting earth currents. This ammeter should give no reading providing the system is in proper order; and any current showing on it will give timely warning that a fault has occurred on the network, and that currents are returning to the station *viâ* the earthing plate—namely, outside the metallic circuits which are provided for their safe return.

(*To be continued.*)

## A COKE-OVEN EXPERT'S VIEWS ON THE RECOVERY OF BENZENE, TOLUENE, &c., FROM COAL-GAS.

From benzene and toluene being classified by the chemist as coal-tar derivatives probably arises a mistaken popular impression that the chief source of the country's supply of these products is from the distillation of tar. Such, however, is not the case; the amount carried forward in the gas being invariably many times the amount deposited with the tar. Thus in regard to toluene—speaking not of the total amount, but of the amount which in practical working it is possible to recover in a pure form—one may say that while from 0·01 up to possibly 0·05 gallon can be extracted from the tar from one ton of coal, from over 0·20 to as much as 0·50 gallon can be recovered from the gas after the tar is deposited. The figures are variable in both cases for different coals, and even for the same coal when differently treated; but in general, under equal conditions, freshly-wrought coals from the pit, and from the same district, show a yield of products roughly in coincidence with the percentage of volatile matter in the coal. Outcrop, stock, or weathered coal does not conform to this rule, but gives a low yield.

The majority of bye-product coke-ovens working in this country recover benzol and toluol. Some recover it in a crude form as naphtha, from which refiners manufacture pure products; but in most of the large installations the manufacture is completed at the coke-works. The coke-oven process is a simple one; the difficulties lying in the detailed application. After the ammonia has been recovered, the cooled gas, at a temperature of 60° to 65° Fahr., is washed with cold absorbing medium, also at about 60° to 65° Fahr. This absorbing medium is then heated, and the products driven off by steam.

In coke-oven practice it is generally recognized that the best commercial medium for the absorption are those light creosote oils from tar which distil between 220° and 250° C. Heavier oils, distilling at from 250° to 300° C., are not quite so good, but nearly so. In commerce, the lighter oils have a tendency to carry dissolved naphthalene; and the heavier oils carry more pitch—both of these substances being objectionable. There is not much difficulty in getting wash oil which shows no distillate at all below 220° C., and 90 per cent. distilling between 220° and 270° C.; the fraction from 220° to 250° C., upon standing overnight at normal temperature, showing no deposit of solid naphthalene. Such oil is in general use; but in use it deteriorates from causes afterwards explained.

The scrubbing area required for benzol recovery is about the same as is usual for ammonia; and it is a matter of some indifference whether ordinary scrubbers, washers of the Livesey type, or rotary washer-scrubbers are used. The latter possibly give the best results, but the former are in more general use. As a general rule, two or more scrubbers in series are provided.

The absorption of benzol, &c., is to a large extent dependent upon questions of vapour tension, &c.; and to secure the best results it is necessary that the oil should not be circulated, but should pass directly through the system in opposition to the flow of gas. The debenzolized oil leaving the stills, after cooling to 60° to 65° Fahr., is pumped into contact with the leanest gas, and upon leaving the unit is pumped bodily into the next one, until, finally leaving the system from contact with the richest gas, it contains from 2½ to 3 per cent. of products.

When complete recovery is the objective, a lower saturation calls for more distilling plant; while with a higher saturation the loss of unrecovered products increases. It is imperative that the oil flow should coincide in volume with the saturation obtained, so as to recover the full output; and as the oil constantly passes through heaters, stills, coolers, and scrubbers, it is necessary that the heaters, stills, and coolers should always be well in excess of theoretical requirements. Thus a plant to recover 2 gallons of products per ton of coal, from 400 tons of coal per day, requires,

with 2½ per cent. saturation in the oil, that the stills should deal with a minimum of 32,000 gallons of oil per day; and if they cannot do this, increased scrubbing plant is of little avail. That heaters, stills, and coolers should be well above their capacity is essential to the complete recovery process.

In distilling the oil, it is necessary to heat it to 115° C. prior to allowing it to come in contact with the direct steam used in the still to vaporize the products and carry them over into the condensers. This temperature is necessary to secure a thoroughly debenzolized oil. It is essential that the oil be at least over 105° C. before coming in contact with direct steam; otherwise steam is condensed, and water accumulates in the oil, from which, with commercial creosote, only distillation can separate it. This is most detrimental, because water being roughly twice the specific heat of oil it diminishes the distilling power, and through this, and dilution of the oil, lowers the scrubbing efficiency as well, besides which there is also ample evidence that if the water exceeds 3 per cent. or so, corrosive actions are developed upon the heater coils, &c., which increased amounts of water accentuate to such a degree that a new heater-coil has been known to be pitted through with innumerable holes inside 48 hours.

It is not general in coke-oven practice to use the hot outflowing oil from the still for heating cold inlet oil, except (say) through the first 30° C.—to about 50° C.—because, compared with other means, such a plant would be both cumbrous and expensive. It is more usual to heat the cold oil by utilizing the outgoing steam and vapours from the still in indirect contact; and there are plants at work with such heaters raising the oil to 60° and 80° C. Supplementary to these preliminary heaters there is usually an indirect steam-heater, in duplicate, as a provision against corrosion troubles, &c.; the heating surface usually being solid drawn tube in the shape of a coil. This heater should, if possible, be supplied with high-pressure or superheated steam. The transfer of heat from the heating means to the oil is governed by the difference in mean temperature on each side of the plate, which is the reason why high-pressure or superheated steam is preferable, and why the outlet oil cannot be used economically above a certain point for heating the inlet oil.

Preliminary heaters are not a necessity; though their use is economical. The whole of the heating can be done by an indirect steam-heater. No indirect steam-coils are usual in modern stills. The maximum temperature is attained in the preheater before the oil enters the stills; and as upwards of 90° C. oil starts to give off vapour, a space of 18 inches or so is allowed at the top of the heater above the oil outlet level, which is connected by a pipe to the vapour space of the still itself. Otherwise, on entering the still, the oil would froth over into the condenser.

The still itself is designed to bring the oil in close contact with direct steam which is blown in at the bottom, and bubbles through trays containing the heated oil passing downwards, carrying with it the products, as vapour, into a water-cooled condenser. The condensed liquids run mixed into a separator, which, by the action of gravity, separates the products from the water. The heated oil enters the still from two to three feet below the still-head, to allow for any frothing which may occur; and above this space a simple form of dephlegmator is usually placed—the best form being the indirect preliminary oil-heater referred to above. Leaving the still by means of a seal pipe or syphon, the debenzolized hot oil passes through coolers back to the scrubber pumps. A coil of cast-iron pipes, water-sprayed to keep the surfaces moist, if of sufficient area, is as useful for this purpose as any elaborate apparatus.

The product is now crude naphtha, containing from 70 to 80 per cent. of benzol, &c.; the balance being creosote oil with some naphthalene. Where naphtha as such is delivered to refiners, there is thus a constant loss of creosote oil from out of the wash-oil, and, through the creosote replacing this being impure, a constant increase of pitch in the oil; so that periodically the whole of the oil has to be changed or renewed. On the other hand, where the coke-ovens make refined products, an accumulation of naphthalene has to be guarded against by similar means. For these reasons, the plants are usually designed to work with a minimum stock of oil.

The process of refining naphtha is fully dealt with in several technical works; and the process need not be detailed. It is necessary to point out that here, also, the separation of the largest amount of pure products depends upon ample still power and dephlegmating surface being provided. The greater the reserve in these respects the greater will be the yield of pure products. An understanding of the properties and separation by fractionation of benzene, toluene, xylene, &c., from mixtures of the same, points to Dr. Davidson's process being more than feasible; and from observations of defective coke-oven practice, in which complete recovery was not attained, corroborative evidence can be advanced. When considered in the light of Dr. Davidson's discovery, three instances will perhaps suffice to illustrate this.

In the early days, benzol, &c., was recovered by plant consisting of scrubbers, circulation tanks, and intermittent stills. At times, accident curtailed the still power, so that the oil was retained longer in circulation in the scrubbers, when its content of products rose, but owing to the shortage of stills the output fell. On these occasions the product, compared with normal, contained less benzene and an increased percentage of toluene; so that benzene was carried away and toluene retained.

When an inadequate flow of oil for complete recovery passed through two scrubbing units in series—the second bringing all the oil from the first into contact with richer gas—the oil leaving the second unit contained much less benzene than when entering, but more total products. Direct proof that benzene was carried away, and other products retained!

A rotary washer-scrubber, partly filled with oil, and to which no more was admitted while gas was passed constantly for a long period, showed, upon sludging-out, 15 per cent. of products in the oil; and from the known relationship between benzene, toluene, &c., under conditions of complete recovery, and the relationship found on analyses here, most of the benzene, and in this case some toluene, must have been carried away by the gas. It appears then probable that, as water is evaporated by a current of air, so the action of a stream of gas passing through oil saturated already with recovered products brings about an evaporation or vaporization of the products similar in effect to fractional distillation, the gas takes the place of heat. The oil having the greater affinity for toluene and xylene, &c., acts as the dephlegmator, so that the lower boiling point products pass forward and the higher ones are retained. The scientific mind must acknowledge the analogy between the two things, and cannot doubt the successful issue of the process.

After Dr. Davidson's discovery was made known, experiments with a rotary washer showed that, without adding benzol (of which there is a surplus in the gas), by correct limitation of the oil flow alone, most of the toluene, &c., can be retained in the oil, while most of the benzene is carried forward in the gas; and while the process was in operation the fall in calorific value in the gas, as shown upon a recording calorimeter, did not exceed 3 per cent. of the net value.

In reference to the use of tar with a similar object in view, coke-oven practice is absolutely unanimous in looking askance at any admixture of tar or tarry matter, other than creosote or heavy oil, in the absorbing medium. The "wash oil" is changed long before it approaches to the nature of tar, and many devices are employed to get rid of pitch. In cases creosote stills are put in, and used for no other purpose than to extract pitch constantly from the wash oil. When spent oil containing 20 to 25 per cent. of pitch is used in the same scrubbers and stills, the output falls 50 per cent. compared with normal conditions with pure oil.

During those long periods in the past when benzol, &c., recovery showed no profit, the idea of saving the cost of creosote oil by substituting tar was fully investigated by the writer. Under equal experimental conditions, tar, as an absorbent, was only 40 per cent. as efficient as creosote oil; and on account of its viscous nature in practical work, this cannot be realized. This lowered efficiency of tar requires, in compensation, more than a corresponding increase in scrubbing area, or, in the reverse aspect, any works using an apparatus to scrub the gas with tar would get three times the output of toluene by using creosote oil instead in the same apparatus.

It may be true that tar treated by gas with a time factor *ad lib.* is capable of absorbing much toluene; but it will be difficult to find any coke-oven expert in this country who would support the use of tar as an absorbing material under any conditions where creosote could equally be applied. Coke-oven experts have at times had actual experience of diluted tar which has forced this conclusion upon them. When, with oil containing 30 per cent. of pitch, the coke-oven chemist finds the saturation, which with good oil is 2½ to 3 per cent., fall to under 1½ per cent.; when his stills and heaters, in spite of pressing, cannot reach the required temperatures; and when his output drops to 50 per cent. or even less—anyone who suggested to him the use of tar as a scrubbing medium would meet with a cool reception.

## Oil-Mixed Cement Concrete.

A bulletin of the United States Department of Agriculture, by Mr. L. W. Page (Director of the Office of Public Roads), states that, while experimenting in an attempt to develop a non-absorbent, resilient, and dustless road material, capable of withstanding the action of automobile traffic, the writer's investigations led him into a very promising discovery. He found that when a heavy mineral residual oil was mixed with portland cement paste it entirely disappeared in the mixture, and, furthermore, did not separate from the other ingredients after the cement had become hard. The possibilities of oil cement mixtures for waterproofing purposes were recognized; and extensive laboratory tests were immediately begun to determine the physical properties of concrete and mortar containing various quantities of oil admixtures. These tests have now extended over a period of considerably more than two years. Many valuable data have been obtained, through both laboratory and service tests, which demonstrate very definitely the worth of oil-mixed concrete in dampproof and waterproof structures. It has been shown that the admixture of oil is not detrimental to the tensile strength of mortar composed of 1 part cement and 3 parts sand, when the oil added does not exceed 10 per cent. of the weight of the cement used. The compressive strength of mortar and of concrete suffers slightly with the addition of oil, though when not exceeding 10 per cent. of oil is added, the decrease in strength is not serious. Concrete mixed with oil requires a period of time from 50 to 100 per cent. longer to set hard than does plain concrete; but the increase in strength is nearly as rapid in the oil-mixed material as in the plain concrete.

# NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

## ANNUAL MEETING IN EDINBURGH, FRIDAY, SEPT. 3.

## PRESIDENT: MR. J. B. SCOTT, OF COWDENBEATH.

THE Fifty-Fourth Annual Meeting of the North British Association of Gas Managers was held on Friday last in the Freemasons' Hall, George Street, Edinburgh. The attendance numbered about ninety. Mr. J. B. SCOTT, of Cowdenbeath, the President of the Association, occupied the chair. He was supported by members of the Council and by Messrs. James Hutton (the Chairman) and John Bennett (a Director), representing the Cowdenbeath Gas Company.

### INTRODUCTORY.

The PRESIDENT said he was pleased to see such a large turnout at the opening of the proceedings; and he hoped as the day wore on the attendance would be even greater. He did not think those present would regret the decision of the Council in asking them to come to Edinburgh for the meeting. The beautiful hall in which they had assembled was alone worth coming to see; and further they seemed likely to enjoy Edinburgh under the most pleasant conditions, as the weather gave promise of being on its best behaviour.

### WELCOME FROM THE COWDENBEATH GAS COMPANY.

Mr. JAMES HUTTON, who was cordially received, said that on behalf of the Directors of the Cowdenbeath Gas Company, he had pleasure in welcoming the members of the Association to Edinburgh. He agreed with the President in saying that the decision of the Council to hold the meeting in Edinburgh was, on the whole, a wise one. Some of them certainly would have liked to have had the meeting in Cowdenbeath, seeing that Mr. Scott's life-work had been successfully carried on there; but, unfortunately, Cowdenbeath was not altogether suitable for a meeting of this kind—not central and convenient as Edinburgh admittedly was. It gave the Directors of the Cowdenbeath Gas Company real pleasure to observe that the Association had appointed their Engineer and Manager, Mr. J. B. Scott, to be the President for this year. In the years that were past, they, in Cowdenbeath, had recognized Mr. Scott's worth; and it gave them undoubted satisfaction to note that Mr. Scott's professional colleagues throughout Scotland considered him worthy to fill the presidential chair of this old Association. He (Mr. Hutton) was certain their President would discharge the duties of his office in the same satisfactory and efficient manner as he performed the work entrusted to him by the Company with which he was connected. It would give the Directors of the Company much pleasure to meet the members of the Association and their lady friends at dinner in the North British Station Hotel later in the day. They would do what they could to make the function enjoyable. He trusted the meeting would be a successful one; and that the deliberations of the members would be profitable to all.

Mr. JOHN LANG (Alexandria) called for a vote of thanks to the representatives from the directorate of the Cowdenbeath Gas Company who had attended that forenoon to extend a welcome to them. It was a pleasure to have both Mr. Hutton and Mr. Bennett present with them; and they hoped, if it fitted in with their arrangements, that they would remain for some time and take part in the discussions.

### ANNUAL REPORT OF THE COUNCIL AND THE ACCOUNTS.

[See *ante*, p. 388.]

The PRESIDENT said the next business was the consideration of the annual report of the Council and the accounts. So far as the membership of the Association was concerned, he might say that the figures disclosed a decrease of one; but he believed this would be more than made good as the result of the meeting that day. There were still a great many gas managers throughout Scotland who remained outside the membership of the Association; and this point had been fully considered by the Council, who felt strongly that something required to be done. It would be to the benefit of the Association, and add materially to its strength, if the managers to whom he had referred could be induced to join. It would be observed that the Commercial Sections connected with the Association continued to do good work; and it was to be hoped they would extend their usefulness. From the report it would be noted that there was to be no "William Young Memorial Lecture" this year. The Council thought that, in the circumstances in which they were placed, it would be advisable to leave this feature out of the programme. For one thing it would allow their funds to accumulate a little; and, besides, as another reason, it was felt there might be a difficulty in securing a lecturer under existing circumstances. So far as the accounts were concerned, he thought they had every reason to feel gratified with the figures. The General Fund had been somewhat depleted by the grant of £50 made last year to the National Relief Fund. It remained in a healthy condition; and he was sure they were all pleased at the substantial grant they made to the war relief funds last year. During the past year, two claims had been made on the Benevolent Fund; and in this connection he felt called upon to remark that it was a satisfaction to them all to know that such a fund was at their disposal if necessity arose. On the whole, he had the utmost pleasure in moving the adoption of the report and the accounts.

Mr. A. SMITH (Glasgow), in seconding, remarked that the General Account seemed quite satisfactory; but he felt that the printing and stationery item was very high.

The PRESIDENT admitted that the printing account was somewhat high; but there were satisfactory reasons for it. There had been a change in the secretaryship, and that had involved new stationery, &c. Again, the cost had gone up because of the number of circulars which had been sent out to members of the Association as a result of the war. One other reason for the additional expense was due to a change of printers—an alteration which the Council felt it necessary to make. For the first year after the change there was bound to be an increase in the matter of cost; but by another year he anticipated that there would be a considerable reduction in the charges.

The report and accounts were then unanimously approved of.

### APOLOGIES FOR ABSENCE.

The SECRETARY and TREASURER (Mr. Peter B. Watson), having intimated a number of apologies for absence, said it was a gratification to the Council to observe at the meeting one or two visitors from the South, to whom they extended a kindly welcome. He had no doubt they would have had many more visitors from the other side of the Tweed had it not been for the present somewhat stressful days. As things were at present it was practically impossible for a gas manager, on the East Coast at any rate, to get away from his own town; and but for this circumstance he (the Secretary) felt that many friends from the other side of the Border would have been with them.

The PRESIDENT then delivered the following

### INAUGURAL ADDRESS.

Gentlemen,—We meet to-day under circumstances unparalleled in the annals of history; and I hope you will pardon me if I make a slight digression for a moment from the usual topics generally dealt with in a Presidential Address.

### THE EUROPEAN WAR.

I cannot refrain from making reference at the outset to this terrible European war. Millions of men, grim, stern, and dour, are facing each other in the greatest combat the world has ever seen. We have been compelled to turn the homes of our peaceful industries into shell and munition factories; our craftsmen's skill is being employed to devise and construct machines of death and destruction; the wealth of our nation is being drawn upon in a manner undreamt of; and the whole resources of our Empire are being utilized, must be utilized, to take part in this terrible Armageddon. The Kaiser and his Huns, the pirates, and murderers must go under. Our word of honour to Belgium, our duty to our Allies, our own freedom—aye, our very existence—demands that we must fight to the bitter end; and for this the finest manhood of our country and our Colonies have gone forth to join hands with our brave Allies to do battle against the tyrant foe. At the moment, I can think of no words more appropriate to the voluntary actions of these brave fellows than those of our own National Bard, as he applied them to Auld Scotland in one of his famous poems:

> "Auld Scotland has a raucle tongue,
> She's just a devil wi' a rung,
> An' if she promise auld or young,
> To tak' their pairt,
> Tho' by the neck she should be strung,
> She'll no desert."

And thank God this is the spirit of the Empire! Then let this spirit of protection and our love of honour and freedom be an inspiration to us to go on doing our "bit," whatever it may be, and in the end victory will be the reward.

### PERSONAL.

At the last annual meeting of the Association you conferred on me the high honour of President, and I can assure you I appreciate it. Many interesting and important subjects have been brought before the Council during the year, and they, at all times, have given their full support and attendance, which made the work very much easier for me.

The Council have decided to do honour to-day to a worthy member and colleague, Mr. G. R. Hislop, of Paisley, and later we are to have an interesting little ceremony in connection with this matter. It was also decided to leave out the usual "William

Young Memorial Lecture" this year; but I have been fortunate in securing four gentlemen to come forward with papers, which I trust will prove of interest, and bring out good discussions.

### A RED CROSS GIFT.

In addition to the sum voted at our last annual meeting towards the National Relief Fund, the Council have decided to make an effort to raise a sum sufficient to provide an ambulance waggon to be presented to the Scottish branch of the British Red Cross Society for use at the front. The sum required is £450, and a circular has been issued to all members of the Association soliciting subscriptions; and we suggest that the circular might be submitted to Committees, Boards of Directors, and the trading firms who are represented in our Association by extraordinary members, so that all who care may have the opportunity of helping in this most deserving object. If we are successful—as I am confident we will—the waggon will be presented as from the North British Association of Gas Managers, and will bear that name.

### OBITUARY.

I would like in a word to refer to the lamented death of our esteemed colleague and friend, the late Mr. William Blair, of Helensburgh. Mr. Blair, who was President of the Association in 1908, was a man of sterling worth, a true typical Scotsman, quite as much at home in England and Ireland as he was in Scotland. He was well-known in all three countries, and in all was equally beloved and respected. He was a born gas engineer, doing good work all his life, and could claim to be the pioneer of vertical retorts in Scotland. He had just finished his fine installation at Helensburgh, and was enjoying the fruits of his labours when he was cut off.

The death of still another Past-President has to be recorded—Mr. Lighbody, of Renfrew. He occupied the chair in 1903, but owing to his long protracted illness, he has not been much among us since. Although not so widely known as Mr. Blair, he, too, did good work in his own sphere.

Then the gas industry has lost a faithful friend and worker in the late Mr. Edward Allen, of Liverpool. Much has already been said about Mr. Allen's life-work; but I must take this opportunity of placing on record the Association's high appreciation of the valuable services he has rendered to the industry he loved so well. He has often been at our meetings, and always took great interest in the welfare of the Association, especially when acting as President of the Institution of Gas Engineers; and there is nothing surer than that we have lost, prematurely, one of the most outstanding men of our profession.

### THE TECHNICAL PRESS.

I do not think there is another industry so well supplied with technical journals as we are; and I might corroborate the words of one of our Past Presidents by saying, "They are second to none." Weekly they lay before us the best information available of every description relative to our own particular sphere, and they are a store of knowledge to every gas engineer and manager. Neither do they hesitate to strike out on behalf of any member of our profession if occasion arises; and their timely hints and advice are much appreciated.

Yet were you to ask me to-day if I had any fault to find with them I would at once say, Yes; and it is this: When one finds himself in the position I am in at present, he discovers that everything he would like to say has been said already, every subject he would like to deal with has been so ably dealt with already, or possibly I should put it this way—that he agrees so well with what has been said that he is left with nothing to add. That, then, is something like my position, gentlemen; and if I am compelled to go over old ground, please blame the journals for being there before me.

### A RETROSPECT.

Looking back over the past twelve months, we must come to the conclusion that it has been a most eventful time—I make bold to say the most eventful ever experienced in the history of our industry. First came the great shortage of coal, caused partly by the wholesale enlistments of the coal miners and partly by the railways being monopolized for the moving of troops and transports. Coalmasters, in many cases, failed to implement their contracts, with the result that stocks of coal had to be seriously drawn upon, and many undertakings had to purchase at increased prices. The freight of seaborne coal rose to alarming figures, as also did all materials necessary for the carrying on of our usual business. Increased taxation, the introduction of bonuses, together with allowances made to soldiers' wives and families, all went to reduce our balances, and in some cases to bring about deficits.

Our staffs were gradually being reduced through enlistments, and with a few exceptions the sales of gas had declined through restricted public lighting and other economical reasons. The climax, however, was reached when we came to renew our contracts. Coal was being quoted at abnormal prices, and offers for tar products had fallen to little more than half their former rates; in fact, everything had got to such a position that there could only be one solution—viz., a general rise in the price of gas. This was a staggering blow to the gas consumers. In past years, they have been more accustomed to having reductions, and this fact no doubt made the increase of price more acutely felt.

So far as the coal supply was concerned, immediate action was absolutely necessary, not so much regarding the price, but to safeguard a supply for the coming winter, which was of more importance. For this purpose, a national conference of about six hundred representatives of the gas and electricity undertakings was held on the 6th of May last to consider the whole situation. From this conference a large and representative deputation was selected, who, in turn, got into touch with members of Parliament, and were successful in getting them interested in the matter. These members made representations to the Government, who very soon realized the serious position of the coal trade, and the immediate outcome was the prohibition of shipment to all neutral countries, unless under a licence. This had the effect of stopping a good deal of shipping, and the result, of course, was a more plentiful supply at home, and the abnormal prices ruling at the time immediately began to fall. Since then, the Government has taken a firmer grip, and now all coal shipped, either to our Allies or to neutrals, must be sanctioned by licence.

### PRICE OF COAL (LIMITATION) ACT.

Following this, the President of the Board of Trade introduced the Price of Coal (Limitation) Bill, and, at the time of writing, it has just come into operation. It is rather difficult to say, at the moment, what the ultimate result of the Act will be; but I do not think it will lower prices to the extent a first glance would lead one to expect; in fact, I am inclined to think that the prohibition of the wholesale shipment is of far more importance to home industry than the passing of the Price of Coal (Limitation) Act.

The first clause stipulates the conditions of sale; and I would particularly draw your attention to the words "coal of the same description, sold in similar quantities, and under similar conditions . . . " on the corresponding date in the twelve months ending June 30, 1914. According to one reading of this clause, it means that if I were to make a contract to-day, I would have to go back to Sept. 3, 1913, to find the price then, and add 4s. (or the standard amount) to that price.

Let me give you my own case then. In April and May last I took in quotations for coal, and the increase of price ranged from 8s. 6d. to 10s. per ton over last year's prices. I bought a small quantity at this high figure. But, later, when the Government took hold of the shipment, the prices immediately came down; and since then I have been buying from week to week at an average of 5s. increase over last year's prices, or 16s. per ton. Suppose I make a contract now under the new Act, I may have to go back to September, 1913, and there I find my price was 13s., and this *plus* the 4s. allowed by the Act brings up my price to-day to 17s., or 1s. per ton more than I have been paying all the summer. There is not much advantage there, is there?

The second clause says: "The standard amount shall be 4s." The fixing of a maximum price really fixes a minimum, and the chances of making a deal are no longer existing. The coalowners have been twitted with taking the Act lying down; but I think they have been wise. They can see quite a good time in front; and best of all, they are now protected by Act of Parliament, so long as the war lasts and six months after.

Then the amendment which was added during its progress no doubt will relieve a little those statutory undertakings that contracted in May last at very high prices. But it is of no use to the Scottish gas companies, who are practically all non-statutory. It is difficult to see why non-statutory gas companies should not get the same advantages as statutory companies in a matter of this kind, because they are equally supplying a public necessity. It may be our own fault that we are not statutory gas companies, but the result is that those who bought their coal at high prices are compelled to keep up the price of gas accordingly, while the corporations and statutory companies can claim relief, and thereby reduce their price correspondingly, so that it produces, in my opinion at least, a favourable position to statutory company and corporation undertakings.

Frankly, I am not enamoured of the Act, and I may be throwing myself open to a good deal of criticism by thus stating my opinion. But nevertheless it is candid, and represents my views at present. I consider our position would have been amply secured by the Government keeping a tight hold of the shipment of coal, and leaving us to make our own bargains. I do not know how it is going to affect English gas-works, but those of us in Scotland will not gain much, if anything.

### ENLISTMENT OF EMPLOYEES.

The further enlistment of gas employees is giving a considerable amount of worry to many gas managers at the present moment. While we may wish to do our best to assist the War Office authorities by allowing our men to go, there is a limit to our resources, and we have a public duty to perform in keeping our individual districts supplied with gas, &c. Not only so; but as the President of the Institution of Gas Engineers so ably put it at the last meeting, it is perhaps only now that so many realize the important part that the gas industry is playing in the welfare of the nation, by providing dyes, disinfectants, drugs, high explosives, &c., and gaseous fuel for the manufacture of all classes of war material. I am sure we are all proud of the usefulness of our industry; but if we are to maintain it, we must be left with sufficient men to carry on the work successfully.

The obtaining of war badges for our employees was raised with the War Office; but this they refused. Later, however, as you will all have noticed from the information published in the Technical Press, they stated that no objections would be raised to the wearing of a public service badge.

This badge was intended to prevent our men being accosted on the streets. But, of course, it did not keep them from enlisting

if they wanted to; so that something more definite was required. We are much indebted to Mr. Walter T. Dunn for the persistent way he has kept at the War Office officials; and now we know that instructions have been issued to Recruiting Officers to the effect: "That on no account should skilled employees of gas-works be accepted for enlistment, unless they are in possession of a certificate from their employers that their services can be spared." This is so far satisfactory; but one day lately I had a visit of two officers at our works, and the question of what constituted "skilled" employees was raised. They argued that stokers did not come under the category of skilled employees. I wrote Mr. Dunn on the point, and he replied stating that stokers, especially machine men, in his opinion, were skilled employees, and I presume we may take this as being the case.

Regarding the enrolment of munition workers, the position is "that an opportunity will be given to the employer to state, for the consideration of the Minister of Munitions, that the man is engaged on Government or other essential work," &c. I think the latter reason quite covers the case of gas employees.

As to what has actually taken place in the way of enlistment during the past twelve months, I thought it would be interesting and useful if I were able to state in a reliable way the total number of Scottish gas employees enlisted, &c., so I issued a circular to all the works in Scotland asking the information. I sent out 255 circulars in all, and received 203 replies. Only 25 works of importance failed to reply; the others being small works with only one or two employees. From these I have compiled the following figures:—

| | |
|---|---|
| Total number of employees when war commenced . . | 6865 |
| Number enlisted since . . . . . | 1366 |
| Number gone to munition work . . . . . | 45 |
| Number replaced by other workers . . . . . | 1204 |
| Number short of usual staff . . . . . | 207 |

The last question is perhaps analogous, or at least misleading, as the fourth question really gives the figures required. If we deduct the number of replacements from the number gone, then we get the shortage.

The spirit of patriotism among the original gas employees stands out very clearly; the proportions of men enlisting being practically 20 per cent. On the other hand, a large proportion of them have been replaced, and the actual shortage is not so large as we might have anticipated. But it must be borne in mind that many of the men who have replaced the originals must be much less efficient, as in many cases they will be men over military age, and not nearly so fit for the strenuous labour of a gas-works.

Taking into account, also, the great difficulty that will now be experienced in obtaining our extra winter men, I think we are bound to use our united efforts with the war and munition offices to get them to stop entirely the enlistment of our employees, or otherwise to enrol the whole as munition or "other essential workers," so that our staffs may be safeguarded. At the same time, I am willing to accept the doctrine that every economy should be effected in the manufacture and use of gas. The absence of crime in our large cities where public lighting has been enormously reduced shows that the extension of the practice might be safely adopted in every community during the period of the war. Further and other economies might well be introduced; and at a crisis like this, when every penny must be saved, I see no reason why in large cities common stairs and back courts should be lighted all night. The earlier closing of public houses and clubs points to the stair gas being put out earlier—at latest at midnight. Public and private economy is needed to the extent of every farthing; and I do not think I am false to the best interests of our trade when I preach it in the national interest.

### COMMERCIAL SECTIONS AND RESIDUALS.

Residual products are playing no small part in the welfare of our revenue accounts; and I am sure we all agree that the Commercial Sections have done much good work in this as well as in other directions. Matters of varying interests can be discussed at these meetings in a free and easy manner, knowing as we do that no shorthand report is being taken, and that no minutes of the meeting will ever give a verbatim report of the proceedings. Sometimes we hear complaints that the ideals set forth are not being walked up to; but after all humanity is not perfection, and something at least is being accomplished if we are making things a little better than they were. It is a pity, however, to find that the total membership of the Commercial Sections is only 76 out of 160 members of the Association; but I have an idea that if some gas authorities would give their managers a little more encouragement and freedom to attend the meetings, we would have more members, and better attendances. If they do not, they lose money.

The Commercial Sections are justifying their existence in spite of anything that may be said to the contrary. If you remember, two years ago stocks of coke were gradually increasing, and by the spring of 1914 they had risen to almost alarming proportions. Had it not been for the timely discussions at the Commercial Section meetings at that time, I have little doubt but there would have been some serious under-cutting of prices going on. Much can be done by each individual member in his own district, by pushing the sales of coke for various purposes; and when a new customer is secured, he knows that he has the protection of the Commercial Section in retaining that customer.

### SULPHATE OF AMMONIA.

We are to have a paper from a representative of the Sulphate of Ammonia Association, which, after all, is just a Commercial Association. I have no doubt what he has to say will prove interesting, even to those who do not make sulphate, because the selling price of sulphate regulates the price of ammoniacal liquor. Sulphate of ammonia can now be manufactured with advantage in very moderate sized works, and in the country towns the local demand generally equals the supply, so that most of us can sell our whole output locally. Whether we sell locally or for export, it is strongly recommended by the Sulphate of Ammonia Association to produce the best possible quality, so that we may satisfy our home consumers, and be more able to meet foreign competition. Nothing less than 25 per cent. ammonia is asked for, with as low a percentage of moisture and free acid as possible.

### TAR WASHING OF GAS.

The market value of tar has suffered severely through the war, and here we stand to lose in the meantime. The recovery of light oils by washing the gas with tar has proved an interesting subject; and it would seem that quite a new phase has opened out before us. The demand for more of these oils has been the means of inaugurating a process into gas manufacture little dreamed of before by gas managers, and even yet some look at it askance. The pumping of tar through the scrubbers and washers goes distinctly against the old order of things. Yet, there it is in full swing every day and nothing serious has happened; and one outstanding feature is the fact that it is quite applicable to large and small works alike. We are all acquainted with the origin of the process, and it now lies with each individual manager to adopt it. In most cases it is only yet in the experimental stage; still some good results have been obtained. I have had some experience in the matter, and have come to the conclusion that a tower scrubber is the best and most convenient apparatus for tar washing. It is possible to get a better contact in a tower scrubber than in most of the other plants, though a Holmes scrubber also does very well.

I have been tar-washing the whole of our gas since the end of April, and I have been able to increase the light oil content to six times the original amount. I have experienced no ill-effects yet, and the only oncost to be reckoned with is the running of the pump and general supervision. I do not think, however, we are being fairly remunerated; but that this will be looked into in due course, I have no doubt.

There is one point in connection with this process that I want especially to bring before you; and it is this. To the ordinary gas manager of medium and small sized works, the results he obtains are a sort of mystery to him. I mean by that, he has no laboratory at his disposal to make tests, and how can he know, when it comes to selling his article, whether he is getting value? To him the tar is just the same black tar—possibly a little thinner. Meantime arrangements have been made, whereby Dr. Grey, of the Royal Technical College, Glasgow, will make analyses of any samples sent in to him; but I cannot see that this will go on for an indefinite period.

### A SUGGESTION.

Now, gentlemen, I have a suggestion to make—one that occurred to me while writing this address; and I give it to you for what it is worth. We have a Research Fund, which has done little or nothing in research work all its life; and I suggest that we should endeavour to make it a real live fund, and with it constitute and equip a central laboratory in (say) Edinburgh or Glasgow, with a qualified chemist in charge.

This would be of some service to the gas industry of Scotland. We could go there for all sorts of information. Managers could take samples of anything they desired to test; and with the assistance, or permission, of the chemist in charge, they could make the tests themselves. We would then be able to get the mysteries of our doings laid bare to us, and not only so, but we would know when we were getting a fair price for the many articles we sell. A small Committee could be drawn from the Association to take supreme charge of the place.

This is not something for nothing, and funds would have to be raised annually to meet the expenses. But surely enough could be raised from the Scottish gas industry to do this much. If it pays a large works to maintain a laboratory and chemist, it will surely pay a combination of smaller works to do likewise. Possibly the Council will consider the matter.

### THE ALLIED TRADES.

In a word, I would like to refer to the good work done by our constructional, gas heating, cooking, and lighting engineers. The gas plant and meter makers of Great Britain can take their stand anywhere; the gas-cookers, gas-fires, water-heaters, &c., that are now being put upon the market are a credit to the technicians and the draughtsmen who design them. I sometimes wonder if we realize how much easier our labour is being made by the ever-improving class of goods we now have to deal with in all departments; and what is better, it is in every case, so far as I know at present, "All British."

The same can scarcely be said of gas lighting. For some years past there has been a cheap inferior class of fittings dumped on the British markets; and I am greatly afraid some of us have been too ready to take up this line simply because the price made it popular. The British lamp and incandescent burner is a substantial article and gives the best results, and it is now for the

British firms to see to it that the opportunity is seized to take up the whole supply of fittings, burners, mantles, and also the glass. Let us have done with the "Made in Germany," "Made in Austria" brand, and have the good old hall-mark of "All British."

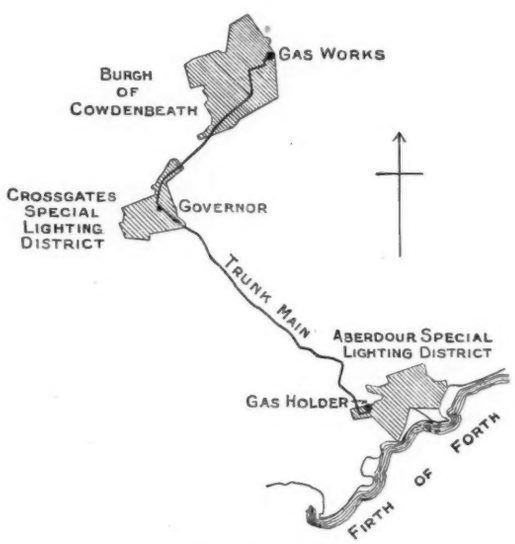
COWDENBEATH GAS.

I do not want to introduce much of the Cowdenbeath element into this address, yet it might appear strange were I to ignore it altogether.

Had Cowdenbeath been a suitable place to hold this meeting, I am sure my Directors would have been delighted to see you there; but being, as it is, a busy little mining burgh, situated right in the centre of the Fife coal fields, I have no doubt you will feel happier away from it. This, however, is not my feeling. I like Cowdenbeath and its people; and if the town is not the picturesque place we would wish, we have only to walk a few miles to reach Aberdour and the beautiful shores of the Forth. Aberdour was the latest addition to our district of supply; and I can assure you it makes a pleasant change to leave the coal pits, with all their disturbing elements, at the one end of the main pipe, and walk along to a trig little summer resort at the other.

We have no real outstanding feature at the Cowdenbeath Gas-Works at present either in manufacture or supply. We conduct our business pretty much on the same lines as other modern concerns. We still cling to horizontal retorts; the labour being made much lighter than usual by the aid of a good coal and coke handling plant. We have good washing and scrubbing apparatus, and manufacture sulphate of ammonia. I have not seen the inside of a purifier for two years. Our employees are all of the long-service order; and thus we glide along very smoothly indeed.

In distribution we sometimes have a difficulty with our mains and services; but that is to be expected, and careful vigilance is the only cure. We have a high-pressure main which runs right through our area and delivers into a district holder at Aberdour, supplying the Crossgates and Fordell districts in passing, and many other country consumers.




**Cowdenbeath Gas Area.**

We have our area divided into three separate districts, and each district is attended to by its own superintendent, who resides within his own boundary, so that he may be within the call of the consumers, night or day. We have a gas-office and show-room in each district; and these we find to be of great advantage.

We have been passing through rather stirring times lately. The Company decided to promote a Provisional Order. This was an old idea that had often been discussed by the Directors, so that they might secure their rights of supply throughout the whole area, and at the same time place themselves under the usual statutory obligations, &c. And it became acute when the Directors were considering the necessity of raising more capital to enable them to go to Aberdour. But you may judge of our surprise when we learned that the Town Council at Cowdenbeath had carried a motion deciding to adopt the Burghs Gas Supply (Scotland) Act, 1876, and purchase the undertaking of the Company.

This was rather upsetting; but it did not deter the Company proceeding with their Order. It was duly advertised in November of last year; while almost at the same time the Town Council advertised the adoption of the Burghs Gas Supply Act. No overtures were suggested by either side, and both schemes went forward. A petition signed by the necessary number of ratepayers was lodged against the Town Council adopting the Gas Act; and this necessitated the taking of a poll of the ratepayers. It was here the first serious difficulty cropped up.

The Gas Company were advised that the method of taking the poll of ratepayers under the 1876 Act was a vexed question in legal circles. Opinions had been got from eminent lawyers in the past—such as the late Mr. J. B. Balfour (afterwards Lord Kinross) and Mr. Alexander Ure (now Lord Strathclyde)—that the proper method of taking a poll of the ratepayers under the Gas Supply Act of 1876 was to be found in the older Burgh Police Acts. On the other hand, it was maintained that the modern method of taking a poll of the ratepayers applied. There is no doubt that in this matter there was a legislative overlook; and the importance of the question is seen when one realizes that if anyone at some later date contended that the adoption of the Burghs Gas Supply Act had not been properly gone about, the whole later transactions relating to the purchase of the Company and the issue of bonds, &c., to pay the price might be reduced as invalid. In these circumstances, my Company presented a petition to the Lord Ordinary to interdict the Provost of Cowdenbeath taking the poll in the method he proposed, and also to interdict the Sheriff of the County of Fife from registering the result of the poll. Within twenty-four hours of the presentation of the petition, the Lord Ordinary heard parties and refused interim interdict. The poll was accordingly taken; and in ordinary course the action should then have gone into the Outer House of the Court of Session to enable a record to be made up and the case properly argued. My Directors were, however, advised that the merits of the case might quite well be disposed of upon the question of an interim interdict, and they accordingly lodged an appeal to the Inner House against the Lord Ordinary's Interlocutor. At the hearing, to avoid complications with the Sheriff, the Town Council of Cowdenbeath agreed that they would not lodge an application to the Sheriff to register the result of the poll until the case had been disposed of in the Inner House. After a learned argument before the Inner House, the First Division, consisting of Lord President Strathclyde, Lord Skerrington, and Lord Johnston, held that the law was that the poll should be taken according to the modern method; so that what was a vexed question for many years in connection with these matters has now been cleared up. I may also say that the solution to this difficult question was got at a minimum of expense. The petition for interim interdict was presented to the Lord Ordinary on Jan. 20, 1915, and the appeal to the Inner House was heard and disposed of on Jan. 26, 1915—that is to say, an authoritative pinion was got upon this important question within a period of six days.

As was to be expected, the poll of the ratepayers went in favour of the Town Council, and accordingly the Town Council are now armed with all the powers of the Burghs Gas Supply Act of 1876. The Town Council immediately gave us notice that they were willing to treat for the purchase of the whole undertaking, including the portion of the undertaking supplying the special lighting districts of Crossgates and Aberdour, outside the burgh. This offer was accepted by the Company; and accordingly the proceedings for the Provisional Order were dropped.

From an academic point of view, it was a pity the Company dropped the application for their Order, because another very nice question arose, which would have had to be solved somehow. As I have mentioned, we supply not only the Burgh of Cowdenbeath, but a large part of the area administered by the Dunfermline District Committee of the County Council of Fife, and of the area administered by the Kirkcaldy District Committee of the County Council of Fife. In the Dunfermline District Committee area there are the special lighting districts of Crossgates and Aberdour, and each of these special lighting districts, or both of them, might have adopted the Burghs Gas Supply Act of 1876, whereupon each of them, and also the Burgh of Cowdenbeath, would have been in the position to serve us with notice that they were willing to treat for the purchase of the whole undertaking. Obviously some legislative solution would have been required for the difficulty; and it seems to me that if the Company had persisted in their application for a Provisional Order giving them statutory powers for the whole area, they would have had a very good chance of getting it, if for no other reason than that it was the best possible means of reconciling the rival interests of the County and the Burgh authorities.

Apart from the legal difficulties that would have been solved by the Company getting statutory powers from Parliament to supply gas within the whole of their area, I think it would have been in the public interest to have put the whole area upon an equal footing under a body which would be subject to parliamentary control regarding capital dividend and price of gas. In the meantime, no further progress has been made, because possibly the Cowdenbeath Town Council will have been informed of the Treasury restrictions upon raising capital for new undertakings. It seems to me, however, that in these proceedings there is an object-lesson for other Scottish non-statutory gas companies. I think that non-statutory gas companies in Scotland have been very foolish in not applying for statutory powers. I think that a statutory gas company offers an excellent solution to the question of how best to reconcile private enterprise with public interest. If Scottish gas companies would go in for statutory protection, there would be no need to municipalize the gas undertakings.

IN CONCLUSION.

I think our Association is managing very well to carry out the work it set out to do fifty-four years ago, and, together with the assistance of the Commercial Sections, the British Commercial Gas Association, &c., I think there is every hope that it will go on increasing in power and usefulness. The Junior Associations are also doing good work; and we hope they will continue to do so, as they in turn will some day be the Seniors. Possibly, we

could help the Juniors a good deal by arranging to let them away to attend meetings, &c.

I do not think we have anything to fear in the future. Given a fair supply of coal and labour, we will surely pull through. We are no doubt up against difficulties, and may get some hard knocks, but I have every confidence in the good old ship "Gas" surmounting all the storms. If we do get a little depressed, or feel the strain a bit heavy, let us remember the brave lads out there, on land and sea, so nobly doing their duty for us; then let us do our duty for them.

At the conclusion of the address,

Mr. A. MASTERTON (Edinburgh) proposed a vote of thanks to the President for the excellent and interesting address to which they had listened with much edification. He felt it would be their own fault if they had not derived considerable benefit from it, because they could all readily understand the amount of attention, study, and deliberation which Mr. Scott had bestowed upon such an extensive survey of matters connected with the gas industry. There was some difficulty in putting into lucid and suitable form one's ideas on the various topics of interest and attractiveness to those engaged in the gas profession; and, likewise, it was not easy to find new subjects upon which to descant. Indeed, the latter difficulty at times necessitated the ringing of the changes upon old themes. The President, however, had been most successful in supplying them with much food for thought, consideration, and study. Without eulogizing further he would, in the name of the Association, thank Mr. Scott for his presidential address and at the same time congratulate him upon his praiseworthy and meritorious efforts.

The motion was carried amid loud applause.

The PRESIDENT, in acknowledging the vote, remarked that if his address proved of the least interest to any of them, he would feel amply repaid for the labour he had expended.

### PROPOSED RED CROSS AMBULANCE WAGGON.

The PRESIDENT said he had a most gratifying intimation to make—namely, that the total amount of subscriptions received for the proposed ambulance waggon to be presented to the Scottish Section of the Red Cross Society on behalf of the Association was £92 18s. 9d. This sum had come to hand from 61 subscribers. In view of the progress which had been made, he sincerely hoped that the members of the Association would take the fullest advantage of the suggestion he had offered in the course of his presidential address and enlist the sympathy and support of their Boards of Directors and Committees. Left to themselves as individual subscribers, it was practically impossible that they could attain the sum aimed at—namely, £450. But if they secured donations through the agencies and channels he had already indicated, the amount they had in view could be realized. Only the previous day he had a telephone message from a gas manager in Fifeshire announcing that his company had agreed to give a donation of £5. If the scheme was taken up in this spirit, and with the same measure of generosity by gas companies generally, they would very speedily secure the sum they had in view. He appealed to the members, therefore, to make this a personal matter, and to do what they could with their Boards and Committees to influence subscriptions for what was, after all, a most laudable object.

[In connection with the above fund, it is interesting to note that Mr. Allan Hannah, of Denny, who is a Commandant of the Red Cross Society (Western District of Scotland) was present at the meeting, and arranged with the Edinburgh Association to have a thoroughly-equipped motor ambulance, which is proceeding to the front within the next few days, sent to the Freemasons' Hall, in George Street, for inspection by the members of the Association attending the meeting.]

### THE LATE MR. ADAM MACPHERSON.

The PRESIDENT said the majority of those present would have noticed the announcement of the death of Mr. Adam MacPherson, late of Kirkcaldy. Mr. MacPherson was one of the oldest members of the gas profession in Scotland, and a well-known member of the Association. He was one of the old landmarks that had gone; and he (the President) felt sure the sympathy of the entire membership would be given to the sorrowing relatives in their sad bereavement.

### A QUARTETTE OF PAPERS.

The four papers on the *agenda* were then read and discussed.

(1) "The Training and Education of Gas-Fitters," by Mr. R. W. Cowie, of Dalkeith.—*See p.* 518.

(2) "A Simple Pressure-Raising Device," by Mr. James J. Scott, of Lower Largo.—*See p.* 514.

(3) "Gas Measurement: Past, Present, and Future," by Mr. Wm. Gordon, of Edinburgh.—*See p.* 515.

(4) "Sales of Sulphate of Ammonia at Home and Abroad," by Mr. F. C. O. Speyer, of London.—*See p.* 512.

### PRESENTATION TO MR. GEORGE R. HISLOP.

The PRESIDENT said they had now reached probably the most interesting part of the day's proceedings—the presentation to Mr. George R. Hislop, of Paisley. Addressing the recipient, he said: On behalf of the Council and members of this Association, I have been asked to convey to you their hearty good wishes and congratulations on the occasion of your completing the long record of fifty years' service as Gas Engineer and Manager of the Paisley gas undertaking. We all felt, even in these distracting times of war, that we could not allow the opportunity to pass without in some small way showing our appreciation of the many great services you have rendered, not only to the town of Paisley, but also to this Association and to the gas industry generally. As colleagues, we are delighted to know that the Town Council and the inhabitants of Paisley, whom they represent, did not forget you in your year of Jubilee, and that they have shown their appreciation of the valuable services rendered to them. We have been blamed in Scotland for paying too much honour to the dead and too little to the living. If this is the case, then, in these days of great changes, let us change this also; for, after all, there is nothing gives a man more pleasure and more satisfaction than to be told that his work is recognized and appreciated. That, then, Sir, is what we wish to tell you to-day. You are possibly the oldest member of the Association, and hold the record of having been three times President. The part you have taken in the work of the Association is well known to all of the older members, and is stored up in our records of "Transactions" for the use of all who care to read. In your earlier days you had the companionship of many famous men. Possibly the greatest of these was the late William Young, of Priorsford; and it must be a pleasure to you to look back and think of the many discussions and arguments that took place in these former days. Your name has been made famous throughout the length and breadth of the land by your good works and the many inventions you have put at the disposal of all—not the least of these being your well-known regenerators. It would be difficult indeed to find another gas engineer to-day with a record such as yours. At the early age of thirteen years you, along with your brother, were appointed Joint Gas Managers of the Lanark Gas-Works; and later you held the position of Manager of the Falkirk and Coatbridge Gas-Works. Then a lucky day dawned for Paisley, when they, in their wisdom, selected you to take up the responsible position of Engineer and Manager of their undertaking. That was in 1865—a date preceding many of our births; so that I think you may be rightly proclaimed the Father of our Association and of the Scottish gas industry. At that time the make of gas at Paisley was something like 80 million cubic feet. To-day it is over 519 million cubic feet; while the price has been reduced from 4s. 2d. per 1000 cubic feet to 2s. 1½d. These figures tell their own tale—that of hard work and capable management. One could dwell long enough recounting the many important works that you have engineered and carried through, but time will not permit me to do so; and, as I have already said, "Who is there among us who does not know 'Hislop of Paisley'"? We would especially like to congratulate you to-day on being still hale and hearty, and able to take your place at our annual meeting, and to still go on with your good work in spite of your advanced years. It is a matter of great satisfaction to us, and I am sure still more so to your own family, to see you enjoying such good health and privileges; and I can assure you it is our sincere wish that you may be long spared to go in and out among us. Believe me when I say that there will always be room for you at the top table of our Association. [Loud applause.]

The President then asked Mr. Hislop's acceptance of a chastely-designed illuminated address. It was designed by Messrs. Gilmour and Dean, of Glasgow, is a beautiful work of art, and reads:

> To George R. Hislop, Esq., Gas Engineer, Corporation Gas-Works, Paisley.—We, the President, Council, and Members of the North British Association of Gas Engineers, desire to take this opportunity of offering you our sincere good wishes and to congratulate you on your completion of fifty years' service as Engineer and Manager of the Paisley gas undertaking.
>
> We also congratulate you on having the honour of being three times President of this Association, and we desire to thank you for the keen interest you have at all times taken in its useful work and welfare.
>
> We acknowledge the great skill and ingenuity you have always displayed in carrying out inventions and improvements for the manufacture and distribution of gas, and we likewise realize our deep indebtedness to you for the valuable services you have rendered to the gas industry.
>
> Our earnest prayer is that you may be long spared to your family and to us, and that your days may be filled with honour, love, and many friends.
>
> Signed on behalf of the subscribers,
>
> ALEXANDER MASTERTON, JOHN LANG, ROBERT W. CURRIE, ROBERT MUIR, C. P. MYERS, DAVID ROBERTSON, WM. WILSON, JAMES M'LEOD, DAVID VASS, L. HISLOP,
>
> J. B. SCOTT, President.
> PETER B. WATSON, Secretary and Treasurer.

Mr. GEORGE R. HISLOP, who was received with acclamation, said he had to salute them all as comrades of the "Light Brigade." He greatly appreciated their kindness in presenting him with the magnificent testimonial. He had not the slightest idea when he was presented with similar tokens of goodwill a few weeks ago in Paisley that he would so soon afterwards be invited to this meeting to be the recipient of still another gift. Frankly, he could not tell them how highly he appreciated their kindness. It was a most interesting reminder. It carried him back to the times that were

gone, and to some of the meetings and discussions which they had in those earlier days. He thought they ought all to feel proud of their profession, for it had attained a position in this country which few industries could boast of. They were struck with the dignity of their profession when they reflected upon its great indispensability in the industrial and social life of the world. The importance of the industry carried with it a corresponding responsibility on those who were associated with it in the public service. At times he looked back somewhat regretfully on the days that were past, and recalled the many old friends who took a lively interest in the Association. He was glad to think, however, that, while a new generation had arisen, it still remembered Joseph. His experience of gas management went back for something like 66 years; and, as one who could speak among them with almost parental authority, he would express the hope that those belonging to this new generation might have health and happiness in the various capacities in which they were employed. His desire was that the young men of the profession would come forward with their papers as in the olden days, so that the world might know that in the gas industry there were to be found men of skill, capacity, administrative ability, and who were altogether well qualified to discharge the many duties that devolved on them. At present they were living in a time of war, which had seriously disturbed both the social and the industrial life of the country. The gas industry had been no exception in the industrial disturbance, because the shortness of coal supplies, strikes, and threatened strikes had been a source of considerable concern to them all. If, however, they set themselves calmly and fearlessly to fight their commercial battles as their soldiers, sailors, and aviators were fighting the greater battles, they were certain to have victory, for he truly believed that God was with them. In conclusion, he thanked them all most sincerely for this tangible token of their goodwill and esteem.

ELECTION OF OFFICE-BEARERS.

It was announced that the ballot for the election of office-bearers had resulted as follows :—

*President.*—Mr. Alexander Masterton, of Edinburgh.
*Vice-President.*—Mr. J. W. Carmichael, of Barrhead.
*New Members of Council.*—Messrs. James Dickson, of Johnstone, and Robert Simpson, of Cambuslang.

Mr. ALEX. MASTERTON (the President-Elect) said that he felt deeply grateful for the honour they had conferred upon him in electing him President of the Association for the ensuing year; and he trusted their confidence in him would not be misplaced. The names of many of those who had occupied this position were well known to some of them; and he would endeavour to discharge the duties of the office faithfully and conscientiously. He would do everything he could to promote the best interests of the Association, and to maintain the honourable record which it had held in the past.

VOTES OF THANKS.

Votes of thanks were passed to the authors of papers, to the Scrutineers, and to the Secretary (Mr. P. B. Watson), for the admirable manner in which he had carried through his onerous duties during the past year.

PLACE OF NEXT MEETING.

The PRESIDENT said he did not think there would be much difficulty in deciding as to the place of meeting for next year. Personally, he did not think they could do better than come back to Edinburgh again. He thought this arrangement would be agreeable to the members.

The suggestion was unanimously endorsed by the meeting.

PRESENTATION TO THE PRESIDENT.

Mr. DAVID VASS (Perth) said a very pleasant duty now devolved upon him—that of showing, in tangible form, the appreciation they felt for their President. Mr. Scott had carried through his work in a very able and pleasing way. His duties that day had been signalized by quite a flourish of trumpets; and this had brought to a close a particularly hard year's work. The circumstances during the past twelve months had been so very different from what they had previously been, and the work on this account had been rendered more difficult and trying. Mr. Scott, however, had shown throughout the year conspicuous tact and wisdom. It therefore gave him great pleasure to present him with the gold badge of the Association as a memento of his successful labours.

Mr. SCOTT said the badge with which they had presented him would be greatly appreciated by him, and would be retained as a memento of an interesting year. It was an honour to be President of the North British Association of Gas Managers, and he hoped the younger members of the profession would aspire to the distinction.

The proceedings then terminated.

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There has been forwarded by Messrs. Hazell, Watson, and Viney, of No. 52, Long Acre, W.C., a copy of the "Water-Works Directory and Statistics" for 1915-16, the price of which is 10s. 6d. It is the thirty-first issue, and, like the "Gas-Works Directory," it contains, in addition to much useful information regarding the various undertakings, a general index of officials of water-works, and a list of Associations of Water Engineers and Managers. A separate section is devoted to foreign water-works with offices in London.

## STANDARDIZATION OF BOMB CALORIMETERS.

There has lately been issued by the United States Bureau of Standards a paper (Circular No. 11) describing briefly the methods of calibrating and using bomb calorimeters, such as are used in determining the amount of heat available from a given weight of coal or coke or other combustible.

The amount of heat which can be obtained depends largely upon the kind and quality of fuel. When purchased in large quantities, a fuel is commonly tested to determine the amount of heat available per pound, and the price paid depends upon the results of these tests. The instrument used for such tests consists essentially of a steel shell or bomb in which a small weighted sample of the fuel can be burnt in pure oxygen gas. The bomb is immersed in a known amount of water before the sample is ignited, the heat produced warms the water, and by suitable measurements of the change of temperature the amount of heat can be calculated.

Provision is made by the Bureau of Standards for standardizing these calorimeters by means of standard samples of certain pure materials—viz., sugar, naphthalene, and benzoic acid. By burning known quantities of these substances in the bomb, the observer determines the amount of heat required to raise the temperature of the bomb, together with the proper amount of water, one degree. This being determined, the heat furnished by a given sample of coal burnt in the same bomb with the same amount of water can be found. Thus these standard samples, which are sent all over the United States, serve as standards of heat, and make it possible to obtain exactly the same results from tests made anywhere in the country, much as the use of the standards of length and of mass makes a yard or a pound the same in all parts of the country.

## EFFICIENCY OF LIGHT UTILIZATION.

The principal known facts to be observed in planning the lighting of small interiors are summarized by Mr. J. R. Cravath in a paper read by him at a meeting of the Chicago Section of the Illuminating Engineering Society (U.S.A.) some little time ago. On points which are still subject of controversy, indications are given as to the course it is meanwhile advisable to pursue.

Dealing with the question of the efficiency of light utilization, Mr. Cravath says that by efficiency is meant the percentage of the light generated which is delivered on a plane level with a common table-top, 30 inches from the floor. This depends on (1) the colour or reflecting power of the ceiling, walls, and floor; (2) the shape of the room; (3) the reflector and globe equipment; and (4) the locations of the lamps.

Colour of ceilings, walls, and floors may, it has been demonstrated, make a difference of over four to one in the illumination. When dealing with common colours, however, a difference of two to one would, he thinks, be the ordinary range, unless it is attempted to use indirect lighting with a dark ceiling, when the ratio would be very high. A low square room will show the least loss of light by absorption, and a high narrow room the greatest. In other words, the greater the wall area in proportion to the floor area the lower the efficiency.

The globe or reflector equipment has a great influence on efficiency. But comparative figures on this must necessarily apply to only one given set of conditions, because the comparative rank of the different equipments will change with room colourings and lamp locations. For example, an indirect system is, obviously, more affected by ceiling colour than a direct system. As to locations of lamps, a central location is more efficient than locations near the walls.

A table covering efficiencies, even for the commonest of practical conditions, would be too bulky for ordinary use. The following will, however, serve to give some idea of the usual ranges of efficiency figures for certain conditions. For a typical room, 15 feet square by 9 feet high, assuming a light ceiling in each case, the light falling on the working plane in percentage of total light emitted by the lamp, with the light all generated by a tungsten or gas-mantle lamp at one central outlet, will be about as below.

| | Per Cent. |
|---|---|
| Efficient bowl-shaped opal or prismatic reflectors at ceiling | 45 to 60 |
| Frosted enclosing globe at ceiling | 25 to 40 |
| Bare unshaded lamp near ceiling | 30 to 45 |
| Indirect, mirrowed reflectors | 25 to 35 |
| Indirect, white enamelled reflectors | 21 to 31 |
| Mirrowed reflector, at ceiling, deep | 70 to 80 |
| Aluminium finished metal at ceiling, deep | 45 to 60 |
| White enamelled metal at ceiling | 45 to 60 |

These figures apply to clean lamps and reflectors.

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Among wills recently proved is that of the late Mr. Richard Clayton, the Managing-Director of the Cannon Iron Foundries, Limited, who left estate to the gross amount of £10,703.

# GAS AND HYGIENE.

By Dr. M. von Gruber, Professor at, and Director of, the Hygienic Institute of Munich University.

(*Concluded from p.* 452.)

## The Ventilating Effect of Gas Lighting.

In the author's experiments, the natural ventilation due to chinks in doors and windows, and the porosity of the walls, was extremely small. In this respect it agreed with the experiments made by Flügge, Emmerich, and other investigators. Pettenkofer appears, the author says, to have much over-estimated natural ventilation. In the experimental room, when not heated, lighted, or occupied, the ventilation averaged about one-third of the cubic capacity per hour. When the room was lighted by gas, but not heated, the exchange of air per hour amounted to about two-thirds of the cubic capacity of the room. Naturally, the ventilation varied in different experiments—being much influenced by the strength of the wind. In a few cases when tests were made in a strong wind, the ventilation exceeded the cubic capacity of the room. It is obvious, however, that gas lighting does not suffice to improve the air of an occupied room, by increasing the ceiling ventilation, to such an extent that the air becomes better than that of an electrically lighted room, as has been contended, especially in England. This contention is most certainly wrong, as figures in Table IV. show.

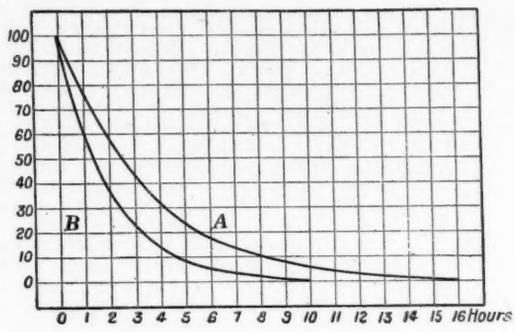


**Fig. 3—Showing the number of spores found in suspension in the air at each hour per hundred spores suspended in the air at the beginning of the test.**
**A = in the room without gas; B = in the room with gas burning.**

## Effect of Wall Paper, Flues, Opening of Doors, &c., on Room Ventilation.

Experiments were next made with a view to seeing whether the ventilation of the rooms could be improved in any simple way. Originally, both rooms had a light wall paper which had become somewhat dirty through lapse of time. Later the paper was stripped from one of the rooms and the walls distempered white, and subsequently the other room was treated in the same way. The white distempered walls naturally caused a considerable increase in the illumination on the table or desk in the room. The results of observations of the temperature, humidity, proportion of carbonic acid, and ventilation of the papered and distempered rooms showed that the ventilation was 17 per cent. greater in the distempered room. On this account distemper seems preferable, and the author sees no hygienic advantage in wall papering. The tabulated results show that the proportion of carbonic acid in the air of the room at the end of each test was appreciably lower with distempered than with papered walls.

Table IV.—*Effect of Occupancy on the Air of a Room.*

| Date of Tests. | Duration of Tests. | Number of | | Total Production of $CO_2$. | Mean Rise of Temperature During Test. | Relative Humidity (Per Cent. of Saturation). | | Increase in $CO_2$ in the Air. | Ventilation. Cubic Feet per Hour. |
|---|---|---|---|---|---|---|---|---|---|
| | | Occupants. | Gas-Burners. | | | At End of Test. | Increase During Test. | | |
| 1913. | Hours. | | | Cubic Feet. | °Fahr. | | | Parts per 10, 00. | |
| Jan. 28 | 4 | 5 | — | 16·0 | 6·3 | 50 | 7 | 27·9 | 1804 |
| | 4 | 5 | 1 | 19·2 | 5·4 | 54 | 12 | 34·8 | 1786 |
| Feb. 28 | 6 | 6 | — | 19·1 | 6·1 | 57 | 21 | 35·8 | 1963 |
| | 6 | 6 | 1 | 24·3 | 7·4 | 58 | 22 | 44·1 | 1857 |
| March 6 | 6 | 6 | 1 | 33·9 | 9·2 | 60 | 29 | 45·5 | 1772 |
| ,, 11 | 6 | 8 | 1 | 41·3 | 10·4 | 62 | 31 | 60·9 | 1670 |
| ,, 17 | 6 | 10 | — | 47·9 | 7·4 | 67 | 39 | 80·0 | 1310 |
| July 7 | 6 | 12 | — | 57·4 | 9·7 | 83 | 25 | 110·5 | 1059 |
| ,, 31 | 6 | 12 | — | 57·4 | 10·1 | 82 | 20 | 125·5 | 854 |
| Aug. 7 | 6 | 12 | — | 57·4 | 10·4 | 88 | 15 | 118·5 | 893 |

In this table two pairs of testings afford comparisons between the electrically lighted room and the gas lighted room—both with the same number of occupants for the same period. The proportion of carbonic acid in the air at the end of the test was always higher with the gas-lighted room, and the humidity was also increased to a greater extent by gas lighting, though in one pair of experiments the difference was very slight. There is no difference in the ventilation—if anything the ventilation appears smaller in the gas lighted room. Stress should not, however, be laid on this observation, as the determination of ventilation in tests with human beings is rather uncertain, because the carbonic acid produced by five or six people cannot be actually measured, but must be calculated from the standard figure of 8 cubic feet of carbonic acid produced per head per hour. There appears to be no doubt, however, that the expectation that gas lighting can improve the character of the air of a room is not fulfilled.

The author's tests likewise fail to substantiate the view that the air of a room lighted by gas becomes freed from organic smell more rapidly than that of an electrically lighted room. Various tests were made. Sauerkraut was cooked for some time in the rooms, and observations were made with cigar smoke. No difference could be observed; for as long as the smell could be detected the intensity appeared to be about the same in both cases, and the time which elapsed before the smell vanished was also the same in both rooms.

The contention, which likewise came from England, that gas lighting disinfects living rooms by destroying the organisms in the air, was made the subject of extended experiments carried out by Dr. Knud Ahlborn. Harmless organisms—viz., the spores of the hay bacillus dried on powdered talc—were introduced into the air of the room by blowing up the dust constantly by electrically driven bellows from eight different points on the floor of the room. At definite intervals measured samples of air were sucked through a Ficker-Hahn filter, and the number of organisms retained thereon was determined. It was not possible to keep the proportion of organisms in the air at the same height in the room more than quite approximately constant, even though the finest dust was used. Constant settling of the organisms occurred; and as it was impossible to reach all parts of the floor with the jets of air, the organisms settled freely in still corners. Fig. 3 shows the results of these experiments.

The curves given represent the average results of a series of tests. It will be seen that there is a rather more rapid fall in the proportion of organisms in the air of the room lighted by gas than in that lighted by electricity; but the author considers the difference inconsiderable and of no practical significance.

Other parallel experiments were made to ascertain the effect of different methods of ventilation. One pair of experiments shows the effect of opening wide and closing the door once every half hour during a seven-hour period. The ventilation was improved by about 10 per cent. by this periodical opening of the door. Other sets of tests compared the effect of taking the air supply to the gas-stove from the corridor with taking it from the room itself. The supply of air to the gas-stove from the room itself improved the ventilation by about 20 per cent. An ordinary stove [of the Continental type], consuming coal or wood, would, the author considers, have a still more thorough ventilating action. In other tests the effect of opening the window flap while the gas-stove took its air supply from the room itself was tried, with the result that it was found that the ventilation was thus increased by 74 per cent. Finally, a series of tests were made in which the vent pipe in the ceiling was opened. This was most effective, the ventilation being increased $2\frac{1}{2}$ to $2\frac{3}{4}$ times, and in one case even 5 times. Obviously, this increased ventilation must affect the humidity of, and proportion of carbonic acid in, the room. The author thinks, however, that these tests with the open vent pipe have not much practical significance, as the lower classes do not have any provision for ceiling ventilation in their living rooms, and probably would not use it if they had. First and foremost they wish to retain the heat, and not allow it to be lost through the ceiling.

## Conclusion.

The author, in concluding his review of the tests made at the Munich Hygienic Institute, says that at the outset no one there doubted that gas lighting was inferior to electric lighting for living rooms in respect of the air, since electric lighting does not contaminate the air, develops no moisture, and produces little heat. It was a question of the extent of the difference between the two. The tests have undoubtedly shown that, even in un-

favourable conditions, such as small living rooms present, the changes in the conditions of the air caused by gas lighting are not nearly so great as has been frequently supposed. It should be pointed out that the results obtained naturally only apply to the experimental rooms used. In other experimental conditions great differences might be found; but, on the whole, it would not be easy to find much more unfavourable or worse conditions for gas lighting than in these tests, which were carried out with small differences of temperature between the interior and exterior, and therefore with the ventilation at its worst. The tests demonstrate without question that the changes of temperature and humidity, and the contamination of the air by carbonic acid, nitric oxide, sulphurous acid, and carbonic oxide, are not sufficiently great to come into consideration from the hygienic standpoint. They do not indicate that gas lighting is undesirable in living rooms. This conclusion the author believes can be accepted with entire confidence.

One point has not been touched upon—viz., the toxicity of coal gas itself. In regard to this, the author would make one observation, not from these tests, but from his daily experiences—viz., that while the bye-pass flames or pilot jets for lighting gas-burners doubtless constitute an advance and a great convenience, the fitting of these jets is frequently faulty. It is obviously an easy matter technically to do this fitting so that an escape of unburnt gas cannot take place; but quite commonly there are small escapes which, when continuing over a long period, may well be injurious. The author has an extremely sensitive nose, and smells tiny quantities of coal gas.

### Discussion.

The discussion on the paper was opened by Professor H. Bunte, who expressed the thanks of the meeting to the lecturer for the extremely careful work on which he had reported. The Professor observed that more than twenty years had passed since an exhaustive investigation of the hygienic aspects of gas lighting had been made, and that since then incandescent lighting had become predominant. Nevertheless, text-books on hygiene still quoted results based on the use of argand and flat-flame burners. Those who had not undertaken similar investigations could scarcely appreciate the time and trouble entailed in the carrying out of an exhaustive research of this kind. Generally speaking, it was a case of detecting traces of gases and of forming a proper judgment on their effect on the health of the human being. It was clearly incumbent on the German Association to support, by all the means at their disposal, investigations of this kind; and there was no one they could look to with greater confidence to make them than to the successor of Pettenkofer in the Professorial Chair at Munich. The report of the investigations showed the great amount of detail involved in their prosecution. Dr. von Gruber had pointed out that his comparisons between gas and electric lighting had been made in conditions extremely unfavourable for gas lighting. These conditions had been chosen so that the greatest effect of gas lighting on the air of the room would occur—small rooms without special ventilation having been used. Notwithstanding this, the difference between gas and electric lighting had been shown to be very trifling. Dr. von Gruber had confessed to surprise that the increase of temperature from gas lighting was so small as compared with electric lighting. It had to be remembered that since the introduction of incandescent gas-burners considerably better illumination was obtained with one-tenth the gas consumption of earlier days; and thus the basis of the old prejudices against gas lighting from the hygienic standpoint had been undermined. The work of Dr. von Gruber and his collaborators led to the conclusion that there was no possible objection from the hygienic point of view to gas lighting carried out in a reasonably proper manner. The products of combustion of gas, apart from carbonic acid and water vapour, occurred in the air of a room in such infinitesimal quantities that they had no possible hygienic significance.

Some precise information on the products of combustion of different gas flames and burners had been obtained by Dr. Terres (one of Professor Bunte's pupils) by testing air taken directly above the burners. The objectionable products were naturally found in this case in a higher degree of concentration than when they were sought for directly in the air of the room. These investigations, however, showed that in gas-flames burning in the ordinary way only trifling traces of products of incomplete combustion occurred, and the most delicate methods of analysis were required for their detection and quantitative determination. As regarded ventilation, Dr. von Gruber had not found support for the English contention that gas lighting increased the ventilation of rooms. It should, however, be observed in this connection that the comparative experiments upon the air in the rooms lighted respectively with gas and electricity had been made in rooms entirely without ventilation. Summarizing the results of Dr. von Gruber's comprehensive and careful comparative tests between rooms lighted with gas and electricity, it might be said that the quantity of products of combustion from gas lighting—such as carbonic oxide, nitric oxide, sulphurous acid, &c., and, to a less extent, carbonic acid, the harmfulness to health of which had been dogmatically asserted and disseminated in a most far-reaching manner—had been proved to be quite insignificant from the hygienic standpoint. Carbonic acid resulting from combustion had been shown to be identical in its action with carbonic acid resulting from breathing or pure artificial carbonic acid. These were results of great value in combating the prejudices raised against gas lighting on behalf of electric lighting. The view that gas lighting enhanced ventilation had never been expressed in Germany; and it gratified the speaker (Dr. Bunte) that the tests had not given support to advantages which could not be sustained. In one respect special attention should be paid to Dr. von Gruber's views—that gas lighting would advance more rapidly if greater care were paid to the fitting in order to enhance convenience and avoid smell. This, however, was no question of scientific investigations, but solely one of technical training and careful work.

Herr Göhrum, the Manager of the Stuttgart gas undertaking, said the exhaustive report of Dr. von Gruber culminated in the point that both the so-called disadvantages as well as the alleged advantages of gas lighting crumbled to nothing. So much had been heard for years past against gas lighting that it became a matter of wonder that other equally great hygienic faults in dwelling houses, such as overheating, had not been studied more closely. Increase of temperature to an extent which the lecturer had said was objectionable hygienically was much more liable to occur in living rooms from coal and coke stoves, which were provided with only restricted means of regulation. The rise of temperature from such stoves could be much more disadvantageous than any rise of temperature from gas lighting. The practical conclusion he (Herr Göhrum) would draw was that, in order to get rid of the irrational heating of rooms by solid fuel, gas should be supplied for heating purposes at a low rate, and that convenient regulators of gas-fires should be provided in order that rooms might be heated with only small fluctuations of temperature. Experiments had been made with such apparatus at Stuttgart, and it had been found feasible to check gas heating automatically when a lamp was lighted or when the room became more fully occupied. As regarded the ignition of gas-burners, he (Herr Göhrum) had found the "Perio" method of lighting gave to gas all the advantages of electric lighting and was absolutely trustworthy; so that in Stuttgart they now used no other lighting appliances. There were doubtless other good devices; but this was the one which had been specially tested there, and had been found quite satisfactory. In conclusion, he would observe that, while it might be concluded from the lecture that gas used for lighting did not vitiate the air of living rooms, it was clear that, as a heating agent and in other ways, gas had greatly improved the conditions of such rooms.

Herr Schomburg, the Manager of the Gelsenkirchen Municipal Gas-Works, referred to the opinion expressed by Dr. von Gruber that coal-stoves would effect better ventilation than gas-stoves, as the chimney temperature would be higher. He thought this was a wrong opinion, as with the slow-combustion stoves now generally in use the quantity of air taken from the room into the chimney depended on the air control beneath the grate of the stove, and only a very small quantity of air was required to provide the necessary heat. This air supply was undoubtedly considerably less than with gas-fires in which the communication between the room and the chimney was always freely open. Consequently the ventilation with gas-fires would be better than with (close) coal-stoves. He (Herr Schomburg) also thought that ventilation could easily be improved if the heat from the gas-burners were utilized by means of ventilating shafts. Many such arrangements had been provided by the Berlin Corporation Gas-Works, the Potsdam works, and others, and had behaved well. In regard to Herr Göhrum's remarks, he did not think that coal-stoves could be entirely superseded by gas heating; but there was still a large part of the heating requirements which could best be met by gas, especially in the transition seasons of autumn and spring. Gas heating was especially applicable to rooms where constant heating was not needed. The complaints of leakage from pipes or pilot jets arose chiefly from the defective taps which were largely sold. If the gas undertakings took a greater part in controlling the fittings, these complaints would vanish. At Gelsenkirchen, a considerably more substantial bye-pass tap had been used, which did away with the fault complained of.

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**The Rare Earth Industry.**—There has just been published by Messrs. Crosby Lockwood and Son a book entitled "The Rare Earth Industry: Including the Manufacture of Incandescent Mantles, Pyrophoric Alloys, and Electrical Glow Lamps," by Sydney J. Johnstone, B.Sc., together with a chapter upon "The Industry of Radioactive Substances," by Alexander S. Russell, M.A., D.Sc. The volume is the second of a projected series of manuals on Industrial Chemistry which are being prepared under the editorship of Geoffrey Martin, Ph.D., D.Sc., B.Sc. A fuller notice of the contents of the book (which is published at 7s. 6d. net) will be given in a subsequent issue.

**Gas-Works Statistics of Japan.**—Statistics for the year 1913 prepared by the Imperial Gas Association of Japan show that there were at that time in operation in Japan proper 75 gas companies, as compared with 74 in the previous year; and in the Colonies four, against three. The small net increase is due to amalgamations and dissolutions of local gas companies which were brought about during the year. Several additional works were at the time in course of construction. Most of the undertakings were, of course, manufacturing coal gas; but in one case natural gas was utilized, and in four others acetylene. The natural gas industry of Japan is not yet developed to any considerable extent; but a scheme has been under consideration having this object in view.

# THE NORTH BRITISH ASSOCIATION PAPERS.

READ AND DISCUSSED IN EDINBURGH, FRIDAY, SEPT. 3.

## SALES OF SULPHATE OF AMMONIA AT HOME AND ABROAD.

By F. C. O. Speyer, of London.

On behalf of the Sulphate of Ammonia Association I wish to thank you for permitting me to be present to-day, and for affording me so good an opportunity of explaining and enlarging upon one or two aspects of the problem of sulphate of ammonia sales.

### Competition from Synthetic Ammonia.

The broad facts of the situation are known to all, and there is fortunately no dispute about them. We are all agreed that sales of sulphate of ammonia in the British Isles are not nearly as large as they could and should be; and we all know that the world's production of nitrogen, whether in the form of sulphate of ammonia, nitrate of soda, cyanamide, or Norwegian nitrate of lime is rapidly increasing. Furthermore, we have lately learnt that, owing to the war, the Germans have vastly enlarged the plant by which they produce synthetic sulphate of ammonia testing 25 per cent., so that the total German production will probably amount to some 800,000 tons in the near future.

These are the facts. The conclusion to be drawn from them is that after the war competition in the world's nitrogen market will be more severe than ever before, and that this competition will inevitably have the effect of reducing the level of price by many pounds per ton, unless old markets can be developed and new outlets found. So far I think we are all agreed. As to the ways and means of dealing with the situation which confronts us, there will, of course, be differences of opinion.

### Propaganda Work.

I may perhaps remind you here that the Sulphate of Ammonia Association (or rather the Sulphate of Ammonia Committee, as it used to be called) has for a number of years been carrying on propaganda work both at home and abroad. As a result, the sales in this country have shown a steady increase year by year, and fresh markets have been largely developed abroad. Our work in this country has hitherto been on scientific rather than commercial lines, although advertisement has formed a large part of our activity; but we have now come to the conclusion that the commercial side of the problem should receive more attention.

### Cultivating the Home Market.

It has been the unvarying experience of those who have succeeded in promoting a large increase in sales in foreign countries that it is not enough merely to demonstrate to the farmer the use and value of sulphate of ammonia. If he is to take to sulphate of ammonia, you must ensure that he has close at hand a never-failing source of supply; and if he is to give preference to sulphate of ammonia, you must endeavour so to regulate the price that sulphate is at least as cheap, unit for unit, as other forms of nitrogen which can be used in a similar manner.

Now the best way to secure for the farmer a constant supply ready at hand is to encourage manure and agricultural merchants to stock sulphate of ammonia. There are three distinct advantages in this method, as against the method of direct selling by the producer to the farmer:

(1) As soon as the merchant has a stock to dispose of, he will naturally set about getting as many orders as possible. This means a good advertisement for sulphate of ammonia; for the best form of advertisement is undoubtedly the living one.

(2) The producer is not faced with the problem of having to give the long credits which farmers so often require, and which the manure or corn merchants are in the habit of granting.

(3) The farmer always knows where he can get sulphate of ammonia, for the merchant draws his supplies from different producers; whereas if the farmer is in the habit of buying direct, it may often happen that his particular friends are sold out, in which case he is more likely to buy nitrate of soda—always obtainable close at hand—than take the trouble to write round to producers of sulphate of ammonia at a distance.

The Association therefore ask you to support the manure and corn merchants, and make it a rule to keep your price to farmers at 10s. per ton above the price to merchants. Let me deal with one or two misconceptions which appear to have lately arisen in this connection.

In the first place, let me say that this 10s. per ton which we are asking you to allow the merchant does not really represent any additional sacrifice to the producer. For years now the prices of sulphate of ammonia have been established on a basis of a discount of 3½ per cent. All we ask you to do is to allow this same 3½ per cent. to the home merchant, just as you do to the export merchant—merely making the allowance up to 10s. per ton whenever 3½ per cent. on the price amounts to less than 10s. per ton.

Secondly, we realize that a large number of producers (especially those situated in the midst of agricultural districts) have for years been building-up a direct trade with farmers. We do not ask you to give up direct selling immediately. We take the view that if the merchant is to make 10s. per ton, he must do something to earn it. We therefore ask you to say to merchants: "We will maintain a difference of 10s. per ton between our prices to you and to farmers whether we do the business through you or direct; but if you want the 10s. per ton, it is up to you to induce the farmer to give you his orders." I may add that the Association, not being in the happy position of having direct farmer customers, make it a practice to refer all inquiries from farmers to merchants.

Thirdly, and lastly, we often receive letters from producers asking why they should lose 10s. per ton to please the Sulphate of Ammonia Association. Well, I do not admit that they will lose anything in the long run. We are firmly convinced that it is only by enlisting the support of merchants that we can hope to effect a large increase in sales here. Every increase in the quantity sold here tends to raise the price both here and abroad; and in this way I feel convinced that producers will be more than compensated for the apparent present sacrifice of 10s. per ton. After all, the 3½ per cent., or 10s., is always allowed to the export merchant; so that three quarters of our total make is already sold under this disadvantage. I understand that north of the Tweed, at any rate, the policy I have outlined above has been acted upon for many years already; so I hope I have so far been preaching to the converted.

### Overcoming Price Fluctuation.

Now I come to the recommendations of the Special Sub-Committee of the Association appointed to deal with the question of home sales. From inquiries made among factors and merchants, we are convinced that one of the principal causes which militates against increased sales to them in this country is the difficulty of saying at any given moment what the price of sulphate of ammonia is. This is due to the fact that producers are constantly competing one against another. Last season we had several instances of prices at two gas-works only about fifteen to twenty miles distant one from another differing by as many shillings per ton. Added to this, there are constant fluctuations in the general level of price.

These differences naturally make merchants chary of committing themselves and encourage farmers to wait till the last moment before buying. The result of this is a rush of orders in the spring, frequent disappointments and consequent loss of orders which go to sellers of nitrate of soda and nitrolim instead. Merchants should be encouraged to buy as far ahead as is reasonable; but they will only do so if they can feel reasonably secure against being undersold when the time for taking delivery arrives. If producers have sales on their books by the end of September or October for the greater part of the quantity required by British farmers in the spring, the market will be enormously strenthened thereby.

In order to steady prices as much as possible, the Association, therefore, ask producers in the various districts throughout the country to agree upon one fixed price for home sales. The price is to be fixed by the producers themselves at meetings to be held at the end of each month in each district; and the price fixed is to remain in force for one calendar month. Let me take an example: At the end of September prices will be fixed which will come into operation on Oct. 1, and be maintained till Oct. 31. The prices might be fixed thus: For October-November delivery, £15 5s. per ton in single bags for 24½ per cent. ammonia minimum guaranteed free on rails at works, net cash to farmers, and cash less 10s. per ton to merchants; for December-February, £15 7s. 6d.; and for March-May, £15 10s. At the end of October these prices could be maintained if the situation warranted it, or raised or lowered. The prices will, of course, have to bear some relation to the export value at the nearest large shipping port for prompt and forward delivery; and producers should always take account of the price of nitrate of soda when fixing.

We recommend producers always to supply bags for home sales; but if they cannot, or will not, do this, an allowance of 5s. per ton of sulphate should be made in lieu of bags.

Those makers who guarantee 25 per cent. will, of course, expect to get a higher price, which should also be fixed. I hope that 25 per cent. will have become the normal guarantee before the war is over.

Now I think that this scheme is a perfectly workable one if applied the right way; but there are certain obvious difficulties. What may be a high price for one maker will appear a low price for another. To obviate this, the districts will have to be carefully delimited. We hoped at first that the districts might be coterminous with the Gas Association areas; but it appears that such districts would be too large. If the general principle of our scheme finds acceptance, therefore, we propose to visit producers personally and arrange the largest possible groups compatible with unity of geographical interest.

I think I have said enough to give you a general idea of the scheme; but I shall be pleased to endeavour to answer any questions afterwards.

### Combination v. Competition.

The outstanding fact about the proposal is that it represents an attempt to substitute combination for competition among manufacturers. In other words, we ask you to fix a price which you consider a good enough figure at which to sell, without troubling whether you could obtain an extra 2s. 6d. per ton or undersell a fellow-producer by 2s. 6d. per ton on any particular occasion. You will have noticed that we give great prominence to this principle in the *brochure* which we issued early in August.* I look forward to the time, which I hope is not far distant, when competition between British manufacturers of sulphate of ammonia will have ceased altogether—leaving us free to use our united energies to fight our foreign competitors, to maintain our position in the world's markets, and to find new outlets for our product.

### The 25 Per Cent. Standard.

In order to be able to work closely together, it is very desirable that there should be substantial agreement as to quality and conditions of sale. And this brings me to the question of making 25 per cent. ammonia, on which I have been asked to say a few words. If I wished to deal with the subject in detail, I feel I could not do better than read you the pamphlet "Does it pay to make 25 per cent. Ammonia," which the Association issued a few weeks ago.† I will assume, however, that you have all glanced at the pamphlet, and will confine myself to the main features of the question. One of the great stumbling-blocks to a proper grasp of this question is the persistence in contracts of what I should like to call the "time-dishonoured" guarantee of 24 per cent. That guarantee is to-day absolutely worthless; and the best proof of this is that sulphate of ammonia which only tests 24 per cent. is to-day fortunately almost as rare as the Great Auk.

I have recently had some correspondence with a manufacturer of sulphate, who has taken the Association politely, but roundly, to task for advocating a standard of 25 per cent. without demanding a corresponding increase in price. That is to say, he is not prepared to make 25 per cent. unless he can get 4 per cent. more in the price than he is getting for 24 per cent., and he stigmatizes the Association's efforts in this direction as contrary to sound business principles. He would be perfectly right in this contention if the majority of manufacturers made sulphate of ammonia which really only tested 24 per cent. But they do not. And if they did, those who were making 25 per cent. would probably find they could obtain something in the neighbourhood of 4 per cent. more. Makers have destroyed the force of this argument by their own action. For although many still only guarantee 24 per cent., practically all makers now deliver salt testing nearly 24½ per cent., while the good makes test 24¾ per cent. and over.

In my opinion, the real operative guarantee of British sulphate of ammonia, on the strength of which merchants buy our salt, lies somewhere between 24½ and 24¾ per cent. Therefore, if a maker of 25 per cent. obtains 2s. 6d. to 3s. 9d. per ton more than a guarantor of 24 or 24½ per cent., I should consider that the 25 per cent. maker was obtaining the full extra to which he was entitled. I am speaking now merely from the point of view of the guarantees given or implied for good sulphate of ammonia. I do not deny that there is a great deal of bad sulphate of ammonia still made; and I think that the maker of bad sulphate very often escapes too lightly owing to the fact that merchants usually ship parcels from several different works at the same time, and the good averages-up the bad.

My first contention, then, is that, if you are comparing prices, you must assume that buyers expect to get a minimum of about 24¾ per cent. whatever guarantee they buy on. The view seems to be held in some quarters that all this agitation for 25 per cent. is merely the work of the merchants, who wish to get better prices from their buyers and pocket the difference at the expense of the manufacturer. I do not think this view would be held if sulphate of ammonia had not been for years a sort of Cinderella among the bye-products. While producers have sold gas and other bye-products of coal, and indeed coal itself, direct to consumers, and have therefore become fully cognizant of consumers' requirements in relation to these products, the sulphate of ammonia market has been developed by middlemen. My personal belief is that if makers here had sold their sulphate direct to overseas consumers, the standard guarantee would long ago have been raised to 24¾ or 25 per cent. I have had a good deal of personal experience in foreign markets, and can unhesitatingly say that the demand for better quality has come, in the first instance, from the consumer, and not from the merchant, who, after all, is only there to supply what the consumer wants.

Now, if we were the only, or even the largest, producers of sulphate of ammonia in the world, as we were for many years, we could be our own arbiters as to quality. Buyers would, of course, prefer to buy 25 per cent.; but if they could not get enough of this, they would have to take inferior qualities, and each maker could decide for himself whether it was worth while making 25 per cent. or not. Even so, I believe that, given the increase in the production of other nitrogenous fertilizers, and the care which these producers take to deliver their stuff in the form most acceptable to users, makers of sulphate would in the end have been compelled to make the best possible salt.

### The Nitrate of Soda Fable.

The Sulphate of Ammonia Committee from 1898 onwards have been successfully exposing the fable that nitrate of soda possesses any peculiar qualities which make it intrinsically preferable to sulphate of ammonia, regardless of price. But consumers are carrying this process one step further; and the tendency nowadays is to give a preference to the cheapest form of nitrogen. And in the category of cheapness are reckoned qualities, such as good mechanical condition, which represent a saving in the cost of application.

Only sulphate of ammonia with a very low content of moisture and free acid, and consequently high percentage of ammonia, can be in good condition. We have to-day staring us in the face a most striking example of the extent to which forms of nitrogen are interchanged. In 1913 Japan took from us 114,000 tons of sulphate. For the first seven months of this year she has had not quite 9000 tons; and even if we assume that the shipments for the remaining five months total 20,000—an optimistic estimate—there will be a shortage of 86,000 tons as against 1913. Increased Japanese production may account for 20,000 tons; the rest of the difference is due to the use of bean cake and nitrate of soda, because they have been cheaper forms of nitrogen. I make no apology for the length of this digression, because the facts seem to me to have an intimate bearing on the question of quality.

I remarked that if we were still the largest producers of sulphate of ammonia, the question of 25 per cent. would not be so insistent. But we all know that we no longer occupy this proud position. The German production will soon be approximately twice as large as ours; and practically the whole of this tests 25 per cent. This makes it quite certain that in the future there will be plenty of 25 per cent. sulphate of ammonia to be had at a reasonable price; and there is not the slightest doubt that buyers prefer 25 per cent. whenever they can get it.

If we are to be able to compete in the world's markets, we must be able to offer a quality equally as good as the quality others are supplying. I do not say that it will be absolutely impossible to sell lower qualities; but I maintain that whereas the maker of 25 per cent. will have the whole world's markets open to him, lower qualities will have to find outlets where they can, after the 25 per cent. makers have taken the pick of the orders. This, I think, is the great central fact in the situation, and no amount of argument as to what has been the practice in the past, and what the cost of making 25 per cent. may be, can alter this fact. We may all admit that the British maker has done very well with his 24 per cent. guarantee in the past. Seeing that he could sell 4 or 5 per cent. of moisture and free acid as if they were ammonia, he would have been a fool if he had not done so. But times change; and unless we change with them, others will cut us out. That is why the Association recommends all British manufacturers of sulphate of ammonia to make 25 per cent. now, in order to consolidate our position in foreign markets during the war, and keep the Germans out afterwards.

### DISCUSSION.

The President (Mr. J. B. Scott, of Cowdenbeath) said this was a subject in which every gas manager was interested, whether he manufactured sulphate of ammonia or not, because the selling price of sulphate of ammonia, as they knew, regulated the value of ammoniacal liquor. He had been somewhat interested in the point raised in the paper regarding dealing with merchants, because it just occurred to him that this was a question which could be looked at in two or three different ways. In the place where he was located, his experience was that he could find a demand for the sulphate of ammonia which they manufactured at the works in the district immediately surrounding Cowdenbeath. In some instances, he had sold direct to the farmers; but in the majority of cases he sold to the merchants. His reason for adopting this course was because the merchants dealt with the farmers, and purchased grain, straw, and hay from them. In point of fact, the merchants had a sort of contra account with the farmers. The arrangement seemed to suit both parties, and worked out to their mutual satisfaction. At the Cowdenbeath Gas-Works they naturally wanted to get in their money as quickly as possible; and his experience had gone to show that the accounts were paid much more expeditiously by the merchants than by the farmers. Then, again, they had come to regard these merchants as more or less their agents. It was not always convenient for a gas manager or his staff to canvass the farm-houses for orders for sulphate of ammonia. Such a method of canvassing might be adopted for gas-cookers; but a manager was not quite disposed to solicit orders among the farmers for sulphate of ammonia. The merchants were in a way their agents; and, being so, they required to be paid. If this scheme was gone about in a systematic manner, he was very hopeful of its success.

Mr. Alex. Yuill (Dundee) said a better paper could not have been placed before the Association—especially at the present time—than the one they had heard read by Mr. Speyer. They (in Dundee) had now affiliated themselves to the Sulphate of Ammonia Association; and his view was that the Sulphate Association was playing its part nobly, and assisting them to a greater extent than many were quite conscious of. Before they became associated with the Sulphate Association, the price of sulphate of ammonia was down to between £8 or £9 a ton; but now they were able to command £14 10s. to £15 a ton for it. Personally, he thought this was largely due to the energies of the Sulphate Association. At the present moment, they ought to realize that the Germans, who were now our enemies, had been trying to steal the trade from us. At this juncture, they ought to enlist the sympathy and co-operation of purchasers of sulphate of ammonia.

* See "Journal," *ante*, p. 344. † *Ibid*, p. 124.

He thought they were entitled to give Mr. Speyer a hearty vote of thanks for his informative paper.

Mr. DAVID VASS (Perth) observed that Mr. Speyer might inform them if he knew of any method by which they could get 25 per cent. sulphate of ammonia without the use of a whizzer.

Mr. SPEYER, in acknowledging the vote, said he had to thank the members for the kindly approval with which they had received his paper. He had to confess that he came before the North British Association in fear and trembling, because he was afraid he might be met with all sorts of criticism and opposition. If he could take it that the general principle of the paper had appealed to the members, he would go South again very much encouraged. Through the Scottish Office—and he took it many of them knew Mr. Young, one of the officials there—it was proposed later on to organize an effort by which the gas managers would be seen and interviewed personally—the idea being to get the scheme of fixing prices put into working order. In reply to the question asked by Mr. Vass, he might say that the Association were at present conducting experiments to ascertain if it was possible to get the 25 per cent. sulphate without the use of the whizzer. It certainly was more difficult to secure it, and, indeed, in cases where the employment of a centrifugal machine or a whizzer was not prohibited, it certainly would be better to instal a whizzer. Provided they had a properly-constructed draining-board, and the sulphate of ammonia plant was otherwise satisfactory, he did not himself think there would be any difficulty in regard to the 25 per cent. make. They had now technical experts attached to the Sulphate Association; and they would be pleased to send them out among gas managers, so as to deal on the spot with any difficulties that might arise.

## A SIMPLE PRESSURE-RAISING DEVICE.

By JAMES J. SCOTT, of Lower Largo.

At the present time there are many methods by which the pressure of gas may be raised, and which are all more or less well known. They consist of blowers, fans, boosters, and such like plant; but the pressure-raiser which I am about to describe may possibly appeal to you (as it has to me) as being a small, simple, cheap, and efficient device.

Previous to the erection of the gas-works in Kennoway and Largo districts, there were three separate lighting areas using paraffin oil for public lighting; and on the introduction of a gas supply, the authorities naturally wanted the new light. They further wanted it on the most up-to-date principle, and at the same time within the limits of their finances. After these lighting committees had visited various places, and made inquiry as to the results of automatic systems, they decided to instal the pressure-wave apparatus. The Gas Company offered for, and carried out, the work of erecting the lamps in the three districts, and arranged contracts to maintain the street lighting in every respect.

The introduction of these appliances required an increase of pressure to operate them which I was unable to give, owing to the reserve of pressure at the works not being sufficient. This occurred at both works; and I was compelled to think out some scheme of overcoming the difficulty. Various methods suggested themselves to me: (1) Weighting the holder; (2) installing a fan or booster; and (3) the idea of temporarily converting my exhauster into a booster. I had strong objections to the first method, owing to the possibility of straining the crown of the holder; and in the second method, financial considerations came up against it. I was now left with the last idea, which was the cheapest and easiest to adopt; but after passing through the school of experience with this arrangement, I again came to the conclusion that something else would require to be adopted to obtain the simple, satisfactory results which I had in view.

I had many thoughts on this matter, and ultimately I saw the possibility of steam being used as a suitable agent. What confronted me then was how to utilize it, and what the effect would be. A few crude experiments and tests convinced me as to the ultimate results; and I have now had a device working at both places for almost a year with entire satisfaction.

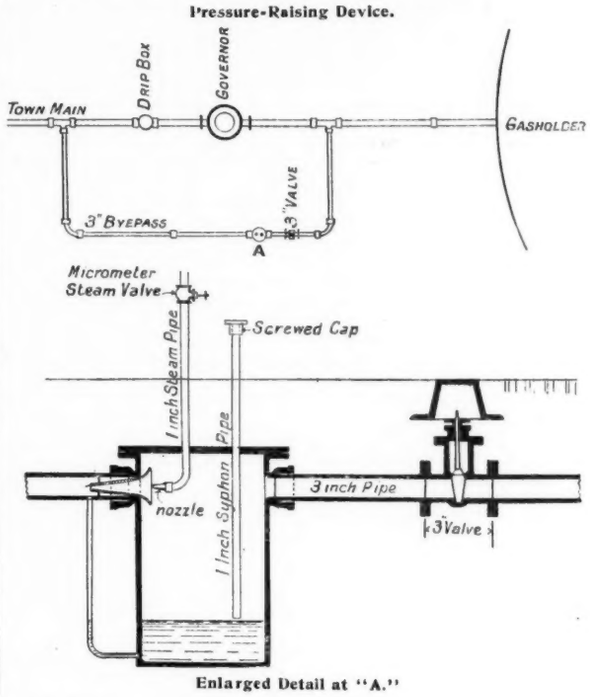
A description of the device can be easily obtained from the drawing; but I might supplement it with a few remarks. The body or chamber consists of an ordinary drip-box with double faucets; and into one of these faucets a bell-shaped conical horn is inserted. A steam supply is brought in through the cover, and the nozzle of the jet is accurately fixed in the centre and in line with the mouth of the horn. The supply of steam is regulated with a micrometer valve; while on the inlet side of the chamber an ordinary gas-valve is fixed. A syphon-pipe is introduced on the outlet to drain back the condensation into the chamber, from which it can be pumped; while a pipe is taken from the side near the bottom, and brought to the surface for the purpose of attaching the pump.

Another drawing shows the arrangement necessary to adopt the device, which I might explain in a few words. The station governor and its connections have to be bye-passed by means of a suitable size of pipe, on which is placed the injector-chamber and the valve.

To create a pressure-wave, the gas-valve is opened, allowing a supply of gas forward to the steam-nozzle. Then the steam-valve is opened slowly, and the action of the steam passing through the horn carries the gas at a high velocity into the district main pipe, gradually increasing the pressure, which, in turn, automatically closes the governor, which prevents the gas passing back to the holder. By controlling the quantity of steam, the wave may be increased to any desired pressure; while the time taken is under the full control of the operator. The steam is gradually shut off, allowing the district pressure to come back to normal, when the station governor again assumes control. The slow, steady increase and decrease obtained are hardly detected by consumers, and are much more effective than any other system in their duty towards the apparatus operated.

The effect of putting steam into the gas is not injurious in the least, as the steam in taking forward the quantity of gas it does is immediately condensed into water, and finds its way to the nearest drip-box, where it can be removed. With one of the installations under my control, the pipe leading from the injector chamber to the main is laid with a run-back to the chamber for a distance of 15 yards, and then turns towards the main pipe. This being so, I have found that the steam does not travel the distance of 15 yards, because about three gallons of water are taken from the injector chamber every week while the device is in operation, and no alteration is noticeable in the quantity taken from the main-pipe drip, which collects about one gallon per month. Another point, bearing on the non-effect of the steam, is the fact that several small bunsen bye-passes are in use throughout the works, and these are quite unaffected.

**Pressure-Raising Device.**




**Enlarged Detail at "A."**

To ascertain the temperature effect of the steam, I had a very fine thermometer inserted in the delivery pipe a distance of 21 yards from the injector chamber. The temperature of the atmosphere registered 70° Fahr., while in the gas-pipe, which is laid at the part with only one foot of cover, it was 60·5° Fahr. During the action of the wave, the temperature actually fell to 60°, showing that the steam was wholly condensed within 21 yards from the injector, and immediately the steam was shut off, the temperature again rose to 60·5°.

I was desirous of finding out the actual detail of the wave as made, and the effect on the district; but the ordinary recorder was too slow for such information. I therefore adapted a recorder to make a complete revolution in four minutes, instead of in twenty-four hours; and this gave me what I wanted. The alteration of the speed changed the direction in which the charts revolved; therefore it is necessary to read these from right to left. They are of interest and explain very clearly the nature of the wave.

Chart No. 1 was taken on the main pipe leaving the works, and shows two separate records, the lower one being a wave of three minutes duration, and the upper one of five minutes. Chart No. 2 was taken at a point out in the district, and compares very favourably with those taken at the works. I might mention that the tenth rise and fall at the start and finish of each record is caused by the opening and closing of the gas-valve. No trace of the action of the station governor is seen. These records were taken under ordinary circumstances; and the operator depends on a dead-beat gauge for indicating his actions. Chart No. 3 shows the nature of a pressure-wave made by allowing the holder pressure on the district by means of a slow acting bye-pass valve. It was taken at a point in the district.

I might now mention some of the outstanding features of the

device as a means of creating a pressure-wave. It has simplicity of working, and is free from governors or any working parts, while it can be installed very easily, and with little cost. It is suitable for the smallest as well as the larger works, and can be operated by any pressure of steam from 5 lbs. per square inch upwards, while the quantity of steam required is negligible.

I have so far referred only to the creating of pressure waves, but I hold the opinion that there are greater possibilities within the scope of this device; and I would like to refer to some of them. Take the case of a works with a two-lift gasholder, the top lift giving 3 inches pressure, and the second lift cupped on, giving 6 inches pressure. During the few hours of maximum output requiring (say) 4 inches pressure, the holder must be kept on the second lift, with the result that all the available retort power is required then, while the remainder of the twenty-four hours the retorts may have to hang. It would seem then that the first lift is of little value so far as pressure is concerned; and to make it useful would relieve the anxiety of some responsible party, as well as making better use of an expensive piece of plant.

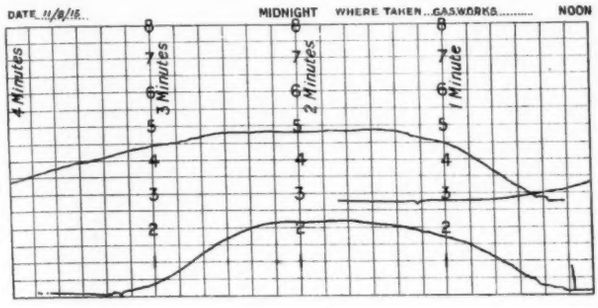



Chart No. 1.

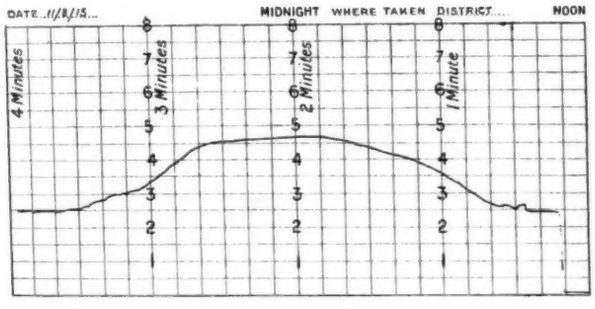



Chart No. 2.

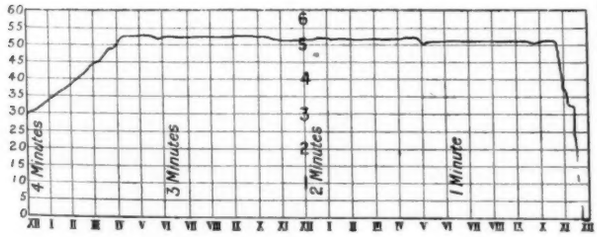



Chart No. 3.

The steam device would serve the purpose very well, and could be fitted in between the gasholder and the station governor. Then just previous to the holder uncupping it could be put into operation, when the gas would be drawn from the first lift and discharged into the governor inlet at sufficient pressure, and would be controlled in the usual way. Even if desired, the steam-valve could be automatically controlled by the governor outlet pressure with the steam-regulator arrangement fitted to the exhausters. Then it is quite possible for the district gasholder to be filled by means of the device.

Another use to which the device could be put is that of testing new main pipes, with either air or gas. A reasonable pressure could be obtained for this purpose; while for district work of this kind, it would be an easy matter to obtain the necessary steam by means of a small portable gas-heated boiler, which generates steam very quickly.

Another use—and a very good one, I think—is that of stand-by or temporary booster in pressure-raising installations. There is always a time when it is desirable, or even necessary, to stop the plant to effect some petty repairs or cleaning; and, in the absence of duplicate plant, this work has generally to be done at very unusual hours, and sometimes at great inconvenience to the district supplied.

### DISCUSSION.

Mr. S. B. Langlands (Glasgow) congratulated the author upon his paper. It seemed to him (Mr. Langlands) that the paper was descriptive of a method by which an old exhauster could be put to a new use. There was much ingenuity displayed in thus putting an old thing to a new use; and it appeared to him that Mr. Scott had succeeded in doing this admirably. His contribution was a very lucid one—a valuable addition to the literature of the Association.

Mr. David Robertson (Dunoon) said the device seemed to be suitable for small gas-works; but he should like to have the author's views as to how it would apply as a means of raising pressure in a 12-inch main covering a district (say) ten miles long?

Mr. Alex. Masterton (Edinburgh) said that, in order to form a correct opinion of the device described, he should like to know what system of pressure controllers was installed in the lamps, and if the pressure required to be raised both for lighting and extinguishing. Also what was the nature of the increase required; how far was the pressure-wave travelling; the increase at the end of the travel; and if wet meters or chandeliers were used in the district?

Mr. Scott, in reply, said his service merely consisted of a simple application of steam to a purpose which he was anxious to have served. The question had been asked, if the arrangement was suitable for adaptation to larger-sized works; and his reply was that he saw nothing to hinder it being used for any size of gas-works. At Burntisland, it was feeding a 12-inch main-pipe; and the supply there was very satisfactory. He had no wet meters or water chandeliers in the district, which was an entirely new one. They had nothing but dry meters in use. He was glad that the paper had created some interest.

## GAS MEASUREMENT: PAST, PRESENT, AND FUTURE.

By William Gordon, of Edinburgh.

As an official appointed by the Magistrates of the City of Edinburgh to administer the Sales of Gas Act, and whose duties are under the supervision of the Standards Department of the Board of Trade, I felt rather reluctant to submit a paper to a gathering of gas managers. On considering the matter, however, I came to the conclusion that it was really in the interest of the seller and consumer of gas that as much publicity as possible should be given to the important subject of gas measurement. The greater knowledge one gets of the scientific methods employed to secure absolute exactness in meter-testing, the greater confidence will be produced between the seller and consumer of coal gas; and it is an undeniable fact that gas authorities are as deeply interested in having correct measuring instruments as are the consumers.

### Past.

In the early days of the distribution of coal gas, the only method of estimating the quantity consumed was by the haphazard one of "computation." This system necessitated charging the consumer a rent for a certain number of burners on the supposition that they consumed a given quantity per hour and were used daily for a stipulated number of hours. The following table of charges will no doubt be of interest to present-day gas managers.

*Gas and Coke Company* (1814). *Reduced Scale of Charges for Seven Days Burning One Twelve-Hole Argand or Batswing Burner.*

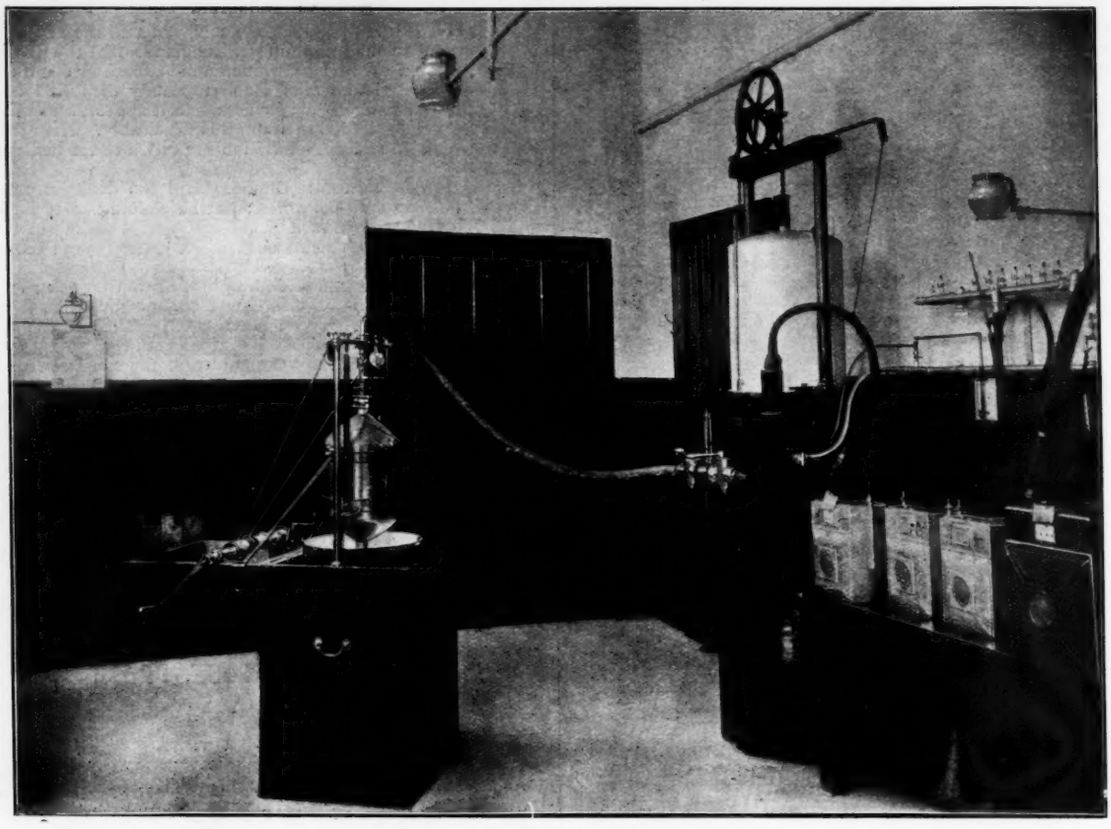
| Time of Burning from Sunset to | Per Annum. | Winter Quarter. | Summer Quarter. |
|---|---|---|---|
| | £ s. d. | £ s. d. | s. d. |
| 9 o'clock . . . . . | 2 8 0 | 0 16 0 | 8 0 |
| 10 ,, . . . . . | 3 0 0 | 1 1 0 | 9 0 |
| 11 ,, . . . . . | 3 10 0 | 1 3 0 | 12 0 |
| 12 ,, . . . . . | 4 0 0 | 1 6 0 | 14 0 |

One hour extra allowed on Saturday nights.

The above arrangement led to considerable confusion, and no doubt opaque window blinds would be in great demand to hide the fact that gas users had not extinguished their jets at the time arranged, and also to prevent spying gas officials reporting same. At this period there were innumerable conditions laid down by the suppliers of gas—one of these being: "The consumer can only receive gas when the mains are charged with gas." I am afraid the gas-using public of to-day would have strenuous objections to such a clause being inserted in their contracts. This method of charging led to many abuses, which necessitated the suppliers of gas charging a price which would indemnify them; and the honest consumer had not only to pay for his consumption but to contribute towards that of his dishonest neighbour. About this time several instruments were invented attempting registration; but the majority of the appliances were much too complicated to be commercially successful. The cubic foot had been adopted by the gas companies as the unit of measurement; but no official certification of its exactness could be obtained.

### Early Days of the Gas-Meter.

To those concerned in the progress and development of gas, it soon became evident that if some instrument could be devised



STANDARD CUBIC FOOT BOTTLE IN USE.

by which the new illuminant could be sold by measure, instead of by "computation," its use would be greatly extended. With the necessity came the man; and in 1815 Mr. Samuel Clegg, of London, invented the first instrument for measuring gas, in the form of a wet meter. Its adoption did not, however, become general until a few years later.

Clegg's 1815 meter was considerably improved by James Malam, and again by Samuel Crosley, whose principle of construction was in general use till Mr. Warner, of South Shields, and Mr. Cowan, of Edinburgh, brought the consumer's wet meter up to a stage of accuracy, from an engineering point of view, by the introduction of a cylinder with a compensating arrangement.

The first record of a dry meter occurs in the patent of James Malam in 1820. The specification showed six pairs of bellows radiating from a hollow shaft, through which the gas is allowed to enter and be expelled from each pair in succession by slits and valves.

From this time down to 1833 no attention seems to have been devoted to the dry meter, and the wet meter held full sway. In that year, however, another type of dry meter was introduced. This was at first a very crude piece of mechanism; but after going through a series of improvements, it was, in its altered form, considered a fairly accurate instrument.

The time at my disposal will hardly allow me to give an account of developments and improvements carried out in gas measuring instruments at this period; but no doubt the subject would make an interesting paper for some future date.

The gas-meter continued, in the face of much opposition, to make progress; and at this time (1857) there were a considerable number of meters of both types in use. Repeated and rather bitter controversies continued to arise, however, as to the accuracy of the gas-meter; and one instance is mentioned where a maker is reported to have stated "that his meters were much better than his rivals' because they were constructed to register more than double the quantity of gas consumed."

### The Sale of Gas Act.

Complaints continued, and became so frequent as to endanger the large pecuniary interests involved; and the numerous companies, with a view to promoting justice and ensuring exactness of registration in gas-meters, welcomed the introduction into Parliament of the "Sale of Gas Act." The Act met with practically no opposition, and received the Royal Assent on Aug. 13, 1859. Experience in the carrying out of the Act led to the introduction of several amendments, which were added in 1860 and 1864.

The Legislature decided to adopt the cubic foot as the unit of measurement for coal gas; and I do not hesitate to say that, even at this time, it would puzzle not a few of our engineers to determine practically what is a cubic foot. The business of preparing this standard measure was no easy one; and the task was confided by the Commissioners of Her Majesty's Government to Professor Airey, the Astronomer Royal, and to Professor Miller, of Cambridge. The duty of constructing the new instrument was entrusted to Messrs. Ladd, of London. A definite volume or bulk—a cubic foot—of an aëriform nature had to be measured with the utmost accuracy. The substance to be dealt with is invisible, highly elastic, varying in bulk with every change in atmospheric pressure or temperature, possessed of a very complex chemical constitution, and liable to be partially absorbed by water. No expense was spared on the work; and the successful construction of this instrument established the unit of gas measurement.

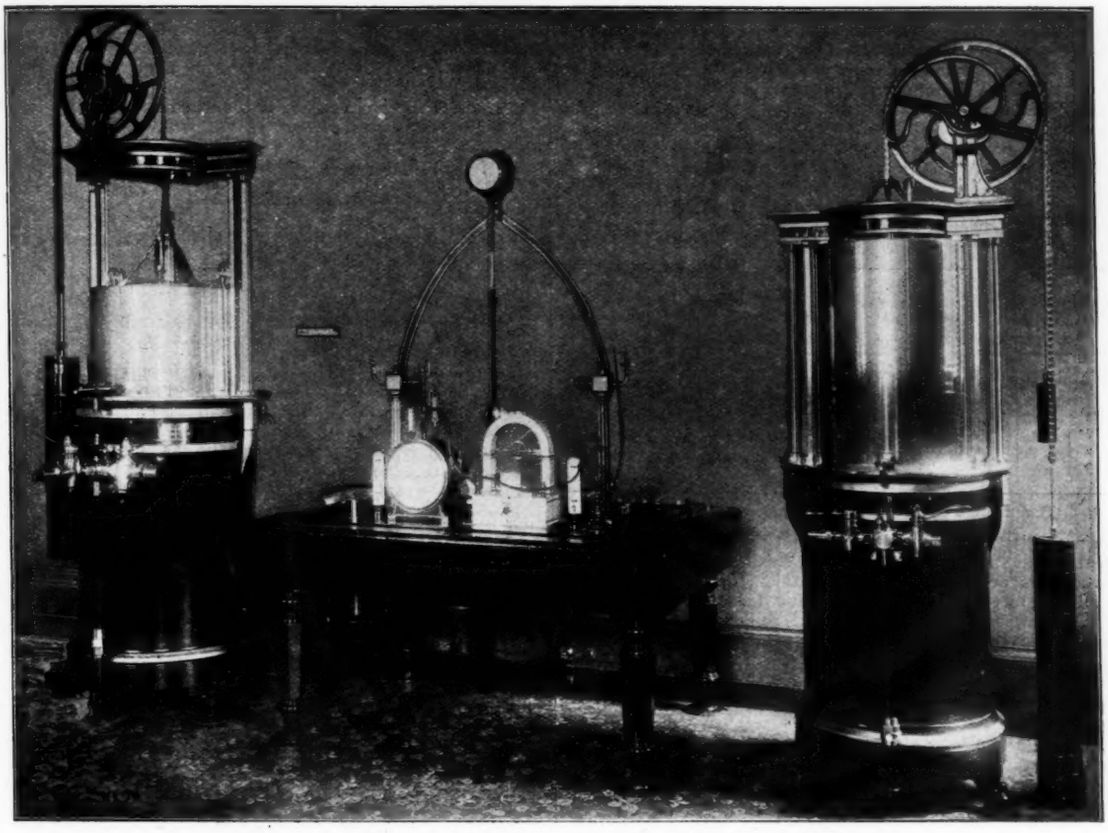
The completed measure is a copper vessel or bottle, in shape a cylinder of 12 inches external diameter with a cone at each end. The cylinder is strengthened with a brass belt at the top and bottom. The measure is constructed to contain 62·321 lbs. weight of pure distilled water; this being the legal weight of a cubic foot of water at the temperature of 62° Fahr., the barometer being at 30 inches. The weight of the bottle slightly exceeds 25 lbs.

Although three standard instruments were constructed—for use in London, Dublin, and Edinburgh—the cubic foot bottle marked "City of Edinburgh No. 3" was retained in London until a few years ago, when, through the courtesy of Major P. A. MacMahon, F.R.S., the Deputy Warden of the Standards, the Edinburgh Gas-Meter Testing Department were granted the custody of the instrument, which I am pleased to have the pleasure of showing you this afternoon.

The apparatus for filling the bottle with water, and thereby displacing into the gasholder the equivalent quantity of air was devised by Mr. George Glover; and the completed instrument is only in a few details different from Mr. Glover's original specifications. In working the instrument the cistern is raised steadily, without the water being agitated, until the water reaches the small orifice which can be distinctly seen through the two discs of plate glass which are specially fitted, and are air-tight. It will readily be recognized that extraordinary exactness can be attained, as the orifice, which defines the exclusion of one cubic foot of air by the water, is only $\frac{1}{4}$ inch in diameter; whereas the holders which the operator is called upon to verify are respectively about 20 and 25 inches in diameter.

The next step in the measurement of gas was the procuring of standard gasholders to serve the double purpose of holding and registering with exactness one charge or several charges of the cubic foot bottle, and, further, of affording the facility of sending their contents through the gas-meters to be officially tested by their means. Standards of a capacity of one, five, and ten cubic feet were constructed by Messrs. Donkin, of London, under the direction of Professor Airey, who entrusted the superintendence of their construction to Mr. George Glover. A few of the principal features in the construction of these handsome instruments may be mentioned.

(1) That the cylinders should be composed of an anti-corrosive metal, capable of resisting the chemical action of the constituents of coal gas and water.



FIVE AND TEN CUBIC FEET GOVERNMENT STANDARD MODELS.

(2) That the surface of the bell should readily part with the water with which it comes in contact during the measuring operations.

(3) That the bell should be correctly balanced, and that a part of the counterpoise, suspended by a cord passing over a spiral, should preserve the equipoise of the bell at the various depths of its immersion in the water of the tank.

The alloy of which the bells are made is sufficiently malleable to allow of its being wrapped round a truly cylindrical mandril, and sufficiently ductile to permit the sheet lapped on the mandril to be drawn through a strong steel collar, by which it is elongated; the surface during this operation being unbroken and highly polished. In soldering the seam after the sheet was rolled on the mandril, a special method was adopted by which, when it had passed through the steel collar, it came out a perfect tube—it being impossible to discover where the joining had been.

The completed standard models have been reported by scientists to be as accurate as it was possible for human skill to make them, and being to all intents and purposes perfect. Another authority has described the models "as a pleasure to the scientific mind to contemplate." Personally, I am confident that no other country in the world possesses gas measuring instruments of equal accuracy, facility of working, or beauty of construction. The one-cubic foot standard, a copy of which we have before us, is precisely similar in form to the five-feet and ten-feet standards which are deposited in the City Chambers. The scales of the one-foot holder are divided into tenths, hundredths, and five-hundredths of a cubic foot. The Edinburgh Corporation value the standard models so highly—there are only four sets in Great Britain and Ireland—that an insurance policy for a very large sum is effected upon them.

The knowledge that reliable instruments had been constructed which definitely allowed official inspectors to decide the vexed question of accurate measurement, gave an impetus to the gas industry, and to a great extent disarmed the adverse criticism which had been directed towards the gas-meter. It also gave greater confidence to the buyers and sellers of gas, and, consequently, the meter became more popular as a measuring instrument. By the year 1862 the new Act was fairly under way, and fully 100 working gasholders had been verified from the standards for the purpose of measuring the registration of gas-meters. The maximum error allowed on working gasholders is 0·0125 cubic foot on 5 feet in excess or deficiency, and 0·025 cubic foot on 10 feet, in excess or deficiency. These working holders are practically identical in construction with the Government standards, but are not so expensively and elaborately fitted.

### First Meter Test in Edinburgh.

In Edinburgh, the first gas-meter was officially tested, found correct, and stamped on Sept. 16, 1861. During the first twelve months 37,605 meters were examined. Of these, 35,923 were wet meters and 1682 dry ones; and 234 wet and 68 dry meters were rejected as incorrect. It may be assumed that a considerable proportion of these meters would probably be submitted for verification, so as to meet the requirements of the new Act.

### Present.

During the years 1861 to 1891, of the meters examined by the Edinburgh Testing Department, the wet type was considerably in the majority. In the year 1891-2, however, the dry meter took the lead; and at the present time the proportion of meters submitted to us for examination is, approximately, five and a half dry meters to one wet meter. In the following table it is interesting to note the progress of the number of meters presented for test.

| Period. | Dry Meters. | Wet Meters. | Total. |
|---|---|---|---|
| 1861-1871 | 56,534 | 289,032 | 345,566 |
| 1871-1881 | 131,241 | 249,467 | 380,708 |
| 1881-1891 | 176,921 | 179,823 | 356,744 |
| 1891-1901 | 392,220 | 168,136 | 560,356 |
| 1901-1911 | 718,509 | 157,675 | 876,184 |
| 1911-1912 | 83,114 | 15,004 | 98,118 |
| 1912-1913 | 78,759 | 11,971 | 90,730 |
| 1913-1914 | 76,825 | 13,572 | 90,397 |
| | 1,714,123 | 1,084,680 | 2,798,803 |

The number of meters rejected for incorrectness is exceedingly low. For the past three years the figures are:—

| | Total. | Rejected. | Per Cent. |
|---|---|---|---|
| Dry meters . . . . | 238,694 .. | 1,744 .. | 0·73 |
| Wet meters . . . . | 40,547 .. | 101 .. | 0·24 |

It should be mentioned that fully 99 per cent. of the old meters submitted for certificate test are of the dry type. The fees drawn since the institution of the department amount to £81,555.

A short time ago an eminent gas engineer invited me to carry out a number of experimental tests for accuracy of measurement

| Pressure. | Consumption. | Result. | |
|---|---|---|---|
| | | Fast. | Slow. |
| Inches. | | Per Cent. | |
| 0·5 | Restricted 30 cubic feet per hour. | 1·01 | — |
| 1·0 | | 1·01 | — |
| 1·5 | | 1·01 | — |
| 2·0 | | 1·01 | — |
| 2·5 | | 1·01 | — |
| 3·0 | | 1·01 | — |
| 3·5 | | 1·01 | — |
| 4·0 | | 1·01 | — |

Temperature of gas in holder and meter, 59° Fahr.

on a 5-light dry meter. The meter had been delivered at his works along with a consignment, and was taken at random from the stores. My instructions were "to test the meter not under the Sales of Gas Act, but at pressures varying from 0·5 inch to 4 inches." [The result of the test is given at the foot of the previous page.]

As it has sometimes been asserted that a sudden increase of pressure in the mains, and, consequently, at the point of ignition—if ungoverned—has a tendency to cause a meter to register incorrectly while passing the increased quantity, we, with a view to ascertaining the effect of varying pressures on the above meter, made further tests the particulars of which are:

| Pressure. | Consumption per Hour. | Result. | |
|---|---|---|---|
| | | Fast. | Slow. |
| Inches. | Cubic Feet. | Per Cent. | |
| 0·5 | 30 | 1·01 | — |
| 1·0 | 43 | Net | |
| 1·5 | 51 | Net | |
| 2·0 | 60 | Net | |
| 2·5 | 68 | Net | |
| 3·0 | 75 | Net | |

Temperature of gas in holder and meter, 59° Fahr.

The preceding figures clearly prove that the gas-meter has now attained a high stage of exactness; and this fact is more remarkable when it is recognized that no mechanical instrument receives, and really requires, so little attention, and does its work so easily and so satisfactorily as the gas-meter. Still greater confidence could yet be given to the public if a system of periodical re-verification of the gas-meter could be arranged—say, at the expiration of ten years from the date of manufacture, or from the previous re-verification.

### Index Testing.

The question of a separate test for gas-meter indices has been under consideration for some time. The subject may, in the early days of gas-meters, have been of importance; but the extraordinary care now shown in the manufacture of meter mechanism greatly minimizes the necessity of interference by the Legislature. Present-day gas consumers have shown no anxiety to have the indices of their meters tested separately. The expenditure incurred in carrying out such a test would be very large; and the benefit gained by the consumers—who would have to pay for the innovation—would be infinitesimal. It should be borne in mind by those who from time to time advocate the laying down of special plant for testing indices, that gas is the only illuminant supplied to consumers through instruments which are officially tested for accuracy under conditions as prescribed by Act of Parliament. So much cannot be said for the rival illuminant.

### Future.

Restricted lighting regulations, to meet the requirements of the moment, have had the effect of interfering with the progress of the use of high-pressure gas for lighting. Consequently, the subject of making provision for officially testing meters which are constructed to register the consumption of gas under pressure has been somewhat retarded.

### High-Pressure Meter-Testing.

To test a high-pressure meter under the existing conditions, as prescribed by the 1859 Act, is of practically no value; and, so far as I am aware, no apparatus has yet been devised which can be used for testing high-pressure meters for accuracy of measurement at varying pressures. The Standards Department of the Board of Trade have been considering the question; but up to the present time no instructions have been issued to Official Inspectors.

It can readily be understood that gas distributed at high-pressure is a complete revolution to the existing low-pressure system when it is explained that the ordinary meter is constructed for use with gas delivered at an average pressure of 2 inches water-gauge, or 0·072 lb. per square inch; a high-pressure meter must be designed for use with gas distributed at a pressure of 80 inches water-gauge, or 2·88 lbs. per square inch and upwards.

The volume of gas varies very considerably under compression, and 1000 cubic feet at atmospheric pressure becomes, approximately:

| | | |
|---|---|---|
| 891 | cubic feet at . . . . | 50 inches pressure. |
| 836 | ,, . . . . | 80 ,, ,, |
| 812 | ,, . . . . | 100 ,, ,, |
| 500 | ,, . . . . | 407 ,, ,, |

There is one point in connection with the distribution of high-pressure gas to which I would venture to draw your attention; and that is the advisability of gas managers deciding upon a definite maximum pressure for distribution purposes. Though the new illuminant has made rapid strides, I feel confident in saying it is still in its infancy; and if a uniform pressure were agreed upon, this would enable the suppliers of the necessary apparatus to standardize their wares. Consequently, the cost of production of these articles would be considerably reduced; and difficulties regarding maintenance, replacements, and storage would thus be minimized.

The question of designing apparatus for accurately testing high-pressure meters is an extremely complex one, and worthy of the attention of gas engineers. We may have an instance of "history repeating itself," and Parliament appointing experts for the purpose of constructing machinery to meet the new requirements; and should those to whom the task is entrusted be as successful as the scientists of 1861, they will, I am sure, not only earn the gratitude of those concerned in the sale of gas, but of the general public.

[The report of the discussion to which the paper gave rise will appear next week.]

## TRAINING AND EDUCATION OF GAS-FITTERS.

By R. W. Cowie, of Dalkeith.

At our annual meetings we almost invariably discuss matters concerning various types of plant for the most economical and efficient production, purification, and distribution of our products; but there seems no reason why we should not also discuss how we can enable our gas-fitters to become more efficient and expert in their various duties, and more conversant with the construction, working, and regulating of the various gas appliances now on the market, so that we may be able to interest and satisfy our consumers in the utilization of gas for the manifold purposes to which it is adapted, and thereby increase our output by making gas indispensable to the general public.

To some of you it may appear out of date for this subject to be brought up and discussed here after what has already been said at the various Association meetings—particularly the Institution of Gas Engineers—and written in the Technical Press. To others, it may seem that the gas-fitters have had too much attention paid to them, and may in consequence become somewhat conceited and attain an undue sense of their own importance. But I trust that all present will agree that there is considerable scope for the better education and training of gas-fitters, and that this branch of our business has been too long overlooked.

So far as I can remember, our Association has not at any of the annual meetings had this subject directly under consideration; and my object to-day is not to lay before you anything new in this direction which has been accomplished in my own town, but simply to introduce, for full and free discussion, a matter of more than a little importance at the present time. It is a subject on which one is tempted to dwell; but I hope to err rather on the side of brevity.

### The Old Conditions and the New.

The work of the gas-fitter now-a-days is entirely different from what it was a number of years ago when flat-flame burners were most common, and gas-fires, gas-cookers, gas-irons, &c., were conspicuous by their absence. At that early period it was quite possible for a man to be a plumber, gas-fitter, sanitary and electrical engineer, bellhanger, &c., all in one; but to-day, from the gas engineer's point of view at least, gas-fitting embraces such a wide field of work and science that it can well stand alone as a distinct trade.

The field for the extension of the uses of gas is a very large one indeed, and the ideal of a gas-cooker and water-heater in the kitchen of every house, and gas-fires in the principal rooms, is yet some way off. In this direction, however, manufacturers of gas-consuming apparatus are doing valuable work by perfecting their various manufactures, making them simple in construction, more efficient as regards economy in the use of gas, more in accordance with the requirements of hygiene and cheapness in working. So long, however, as science and skill, along with man's inventive genius, are applied in the direction of gas heating, lighting, and power, so long will there be improvements and inventions, all of which will consolidate the already strong position of the gas industry.

The gas-fitter of to-day thus finds himself confronted with the duty of keeping himself constantly in touch with the latest devices in connection with which gas is utilized, and the best methods of fixing, adjusting, and working these appliances. It is, therefore, the duty of every gas engineer and manager to see that his staff of fitters, inspectors, and foremen is trained in such a way that the men may be able to deal effectively with any inquiry or complaint received from gas consumers.

As in the past, so will there be in the future some young men who have a wider outlook than others—who are keener to master the details of their work with a view of advancing themselves in their profession. In spite of many difficulties in the way of more full and complete technical education, such men invariably attain their object. On the other hand, there will always be "hewers of wood and drawers of water;" and the majority of young men entering the gas-fitting trade will remain gas-fitters. There is, nevertheless, reason for them to be proud of being such. It is imperative they should be trained; and the duty of every employer is to see that they are trained as well as possible—practically and theoretically; so that their work, besides insuring them their daily bread, may also be a source of pleasure because of their interest in it.

While studying this question, it is well to remember that the gas-fitters in large towns are in quite a different position from those in smaller towns and works. In the former, where there are large works, it is a comparatively simple matter to arrange special classes, either separate from, or in conjunction with, the School Board evening classes or technical schools, and to thus

encourage young fitters to attend these classes, when they can readily sit for the City and Guilds Examinations as well as the class examinations. Again, large gas undertakings can often procure the assistance of the technical experts of the various manufacturers of gas apparatus, who send them, free of charge, to deliver lectures and give demonstrations, setting forth their special features in construction, regulating, fitting, working, &c. It has been my privilege to attend some of these lectures in the City of Edinburgh, from which I derived much benefit.

### Educational Work in Edinburgh.

I have been favoured by our esteemed Vice-President, Mr. Masterton, with particulars of the Edinburgh and Leith Gas Commissioners' scheme for the education and training of gas-fitters, along with the conditions attached to same; and I have pleasure in submitting it here for your consideration.

Boys, generally from 14 to 15 years of age, who apply for engagement as apprentices in the Gas-Fitting Department are interviewed, and their general physical appearance is noted and their eyesight roughly tested. They are asked a few questions as to general health, fondness for exercise, reading, study, &c., and a note of the general results of schooling. Thereafter they are set simple papers in arithmetic, consisting of four sums, one each in simple and compound multiplication, one in decimals, and one in proportion. They are also required to copy out a short paragraph from one of the daily papers or from a technical book, to note their handwriting and accuracy of observation. If they pass this examination satisfactorily, they are sent to the doctor for examination; and if they are passed as sound and healthy, they are taken on and started in one of the show-rooms for about nine to twelve months.

When they are about to leave the show-rooms (which occurs when there is a vacancy in the workshop), they make application in a given form which it is stipulated they should copy in their own handwriting and sign. In this application they state their agreement to the conditions of service which are attached, and which include attendance at the School Board evening continuation classes and the Heriot Watt College for the following subjects: Building construction, mathematics, gas-fitting, plumber work, and other handicraft classes as may be arranged. The parent's signature, as well as that of the applicant, is required both to the application and to the conditions. The papers are afterwards accepted and signed by the Engineer and stamped at the Inland Revenue.

It is almost unnecessary to mention that in every system of this kind there should be careful observation of the personal element. Each year as the winter season comes round the lads at Edinburgh and Leith are addressed by the Engineer, and also by a representative from the Educational Committee, and the advantages of, and facilities for, evening instruction brought clearly before them. Some of the lads who are rather young or a little backward in their general education are advised to take classes in English, arithmetic, and drawing during their first year, and practical mathematics and geometrical drawing for the second year. Others more advanced are sent at once to the continuation classes to study building construction and drawing, plumbers' and gas-fitters' practical and theoretical work, workshop arithmetic and geometry, for the first and second years.

After this, they attend the Heriot Watt College for advanced plumber work, theoretical and practical, or a special gas-fitting class arranged by the Board, and finally advanced physics connected with the gas-fitting and plumbing. They have also now to attend a special class arranged by the School Board in gas lighting and appliances at the evening continuation classes in two courses, elementary and advanced.

### Monetary Encouragement.

As an encouragement to the lads to prosecute their studies with intelligence and vigour, a payment of 6d. per week is given for the junior and 1s. per week for the senior, for each class certificate gained. The highest wages earned last year by an apprentice in his final year was 19s. 6d. per week—18s. being the regular pay, and three additional sixpences gained for junior certificates at classes. These classes in Edinburgh, as in other centres, as you will readily understand, have been greatly interfered with by the war, and also by the great bulk of the lads joining the Army. However, this seems to provide an opportunity for them to look into the matter and put their house in order, and when the war is over to enter afresh into this necessary work.

### Educational Methods in Small Towns.

In the smaller towns it is equally necessary that the gas-fitter be quite as capable as his compeer in the city; yet it is manifestly out of the question for the same procedure to be adopted in his training and education. Gas consumers in small towns are quite as particular with regard to their domestic gas supplies, and the same taste and skill are required for the fixing of gas fires and cookers and every other form of gas consuming apparatus.

It is not sufficient that the fitter be able to lead a pipe from the meter or the main supply in a house to a bedroom or other room and connect it up to a fire; he ought to be able to know how to overcome the hundred-and-one little difficulties which continually crop-up in the course of his work, and be able to give the lady of the house perfect satisfaction, information, and instruction as to the proper use and control of the apparatus. A gas-fitter so capable will not require to be continually followed up in the large towns by inspectors, and in the smaller towns by the managers and their assistants. Considerable economy will therefore ensue; and the manager will be able to devote his time to other more important objects.

How, then, are we to assist the gas-fitter to gain the required knowledge and experience? In the first place, we ought to insist on all apprentices attending continuation classes, even though there is no private arrangement between the School Board and the Gas Department, as mentioned in the case of Edinburgh. We should likewise take an interest in the lads, and see that they get opportunities of acquiring an insight into the construction and working of various appliances in use, and follow up and keep a record of their class progress as well as the results of their various examinations.

### City and Guilds Examinations.

It is just here where the benefits of the City and Guilds examinations come in, as they form a goal for the gas-fitter to work up to. After very careful consideration, much thought, planning, and arranging, the Institution of Gas Engineers have been able to get an examination for gas-fitters introduced into the syllabus of the City and Guilds of London Institute; and this year saw the first of these. One was held in Glasgow in February of this year; but there is no reason why it should not also be held in other centres, if sufficient numbers come forward. I understand from the examiners that the examination was considered quite as successful as could have been expected the first year.

The examinations as you will no doubt know are in three grades. Grade I. is a written examination only, and no certificates are awarded for successfully passing it, though it qualifies for sitting for the examinations in Grade II.

Pass certificates are awarded in Grade II. when candidates have passed both practical and written examinations; the written one following the practical one, and only those who have passed the practical test being allowed to sit for the written examination. Candidates for the final examination must hold a certificate for Grade II. or (until after the examination of 1916) must have served at least four years' apprenticeship to the trade.

This final examination is similar to Grade II., only the practical test is more difficult and the written examination demands a wider sphere of knowledge. First and second class certificates are awarded on the results of this examination.

Our young gas-fitters should be well encouraged to try these examinations and helped in their preparations for them. There must be few towns in Scotland where the continuation classes do not comprise classes for apprentice plumbers and gas-fitters, in which they can get theoretical training and general education which will enable them to express in writing what they really know of their work, and give the answers to questions set at the examinations. As Mr. Halkett pointed out in his report of the examination in Glasgow, this inability to express themselves in words was one of the principal weak points.

Correspondence classes on the subject are of great value, particularly where there are no suitable evening classes. This method of tutoring has its disadvantages; but it possesses this great advantage in giving the student much practice in writing out answers to questions, and in making him study and work. These classes are somewhat costly; but the gas undertaking where the fitter is employed ought to give some monetary assistance, especially on a successful completion of his studies by the passing of the examination.

### Skilled Workers and Certificates.

There are throughout the country many capable men of wide experience who are well up in their trade as gas-fitters, and could be entrusted with work requiring skill, accuracy, and taste, and yet could never face the ordeal of a written examination. The Institution of Gas Engineers very wisely introduced a scheme whereby such men over 35 years of age may become certificated gas-fitters, and thus save them from being envious of their younger workmates, who, though they might be able to pass the required examination, are yet not their equals in practical knowledge and experience.

Particulars of this scheme have been circulated through all the gas undertakings in the country; and it remains for gas-fitters to make application and managers faithfully to fill up the forms, and, if the fitter is qualified, to see that he gets his certificate. This certificate can scarcely rank with the one granted by the City and Guilds of London Institute, and it is well that this scheme is only a temporary arrangement, and that after 1917 all gas-fitters must pass the City and Guilds examination to obtain the certificate.

### Value of Technical Journals.

There must be few gas managers who do not get either the "Journal of Gas Lighting" or the "Gas World" paid for them by their companies or corporations, so as to keep them conversant with the latest inventions and obtain current general information of the industry; and I do not see why the companies or corporations cannot likewise provide the gas-fitters with "Gas: Light, Distribution, and Maintenance." This is pre-eminently a gas-fitters' paper, calculated to do an immense amount of good in the way of quietly and steadily educating the gas-fitter who carefully reads the various articles specially written for him; and though he might never sit for an examination, he cannot fail to be a better and more efficient workman through receiving and reading regularly such literature. The possession of a certificate by the gas-fitter may be a source of gratification to him; but the possession

of more intelligent gas-fitters, whether they be certificated or not, is of more importance to us as managers, and the small outlay on a weekly journal for them will amply repay itself.

When gas engineers and managers in larger towns are having manufacturers representatives to lecture on their goods—the best methods of fixing and adjusting same, their distinctive features, &c., &c.—it would be a good thing for the managers and their fitters in surrounding towns to receive an intimation of, and invitation to, such lectures, when no doubt they would get new wrinkles on various points and their minds refreshed on others.

[The report of the remarks made by members on the above communication is unavoidably held over.]

## CARBONIZING MIXTURES OF COAL AND COAL DUST.

In a recent number of "Het Gas," Heer D. T. Ross van Lennep, the Chief Chemist at the coal mines of the Dutch Government, dealt with the subject of economizing gas coal by the admixture with it of fine coal dust before carbonization. As the plant at the mines was not in working order, the experiments were carried out at the Hague Gas-Works; and the author furnished the following particulars in regard to them.

The coal dust came from the Wilhelmina Mine; and for carbonization the ordinary horizontal retort was used. Three series of experiments were made—one (A) with dust alone, another (B) with a mixture of 80 per cent. of Easington gas coal and 20 per cent. of dust, and the third (C) with the coal alone. The following were the results:

| | A. | B. | C. |
|---|---|---|---|
| Gas produced per metric ton | 8050 cub. ft. | 11,550 cub. ft. | 11,326 cub. ft. |
| Calorific power per cubic foot | 464 B.Th.U. | 554 B.Th.U. | 578 B.Th.U. |
| Sulphur in purified gas | 0·15 grain | — | — |
| Appearance of coke | powder / non-caked | good caked | very good |
| Duration of carbonization | 4 hrs. 48 min. | 4 hrs. 48 min. | 4 hrs. 48 min. |

These results show that from a mixture of 80 per cent. of gas coal and 20 per cent. of fine dust a sufficient quantity of gas and a coke of good quality can be produced. The following is an analysis of the coal:

| | Per Cent. | |
|---|---|---|
| Moisture | 12·00 | |
| Volatile matter | 11·34 | in dried coal. |
| Coke | 88·66 | |
| Ash | 8·17 | |

In the process of destructive distillation there were produced per metric ton of dried coal 4·2 kilos. (9¼ lbs.) of tar and 3·4 kilos. (7 lbs.) of sulphate of ammonia. The composition of the gas (sp. gr. ·20) was as follows:

| | Per Cent. | | Per Cent. |
|---|---|---|---|
| $Co_2$ | 3·1 | $H_2$ | 70·9 |
| $C_nH_m$ | 0·2 | $CH_4$ | 17·3 |
| CO | 4·1 | $N_2$ | 4·4 |

The author remarked that it might be a somewhat peculiar idea to carbonize poor coal containing 10 or 11 per cent. of volatile matter for the production of gas. But he pointed out that this is very often done, and that its admixture with a better kind of caking coal produces coke of good quality; the caking properties of the coal causing the incrustation of the dust. The coke is better caked, less porous, and of greater resistance; and the gas has a higher calorific power than might have been expected from the carbonization of the mixture. This phenomenon is generally observed in the carbonization processes carried on in coke-ovens; and the cause is to be found in the production of a considerable quantity of gas of low calorific power (446 B.Th.U.), and consisting chiefly of hydrogen. This poor gas dilutes the richer quality of that coming from the gas coal, and protects the hydrocarbons against decomposition. It is also of some interest to note that the distillation period for the mixtures containing poor coals is shorter than that for gas coals only. This fact is due to these coals requiring less heat for their distillation, and moreover they have higher heat-conducting power, so that the heat is transmitted with greater velocity to the core of the gasifying mass. In the distillation of such heterogeneous combinations, great care should be taken to ensure a thorough mixing of the components. If this should be insufficient, the local larger amount of fine coal dust causes the binding properties of the gas coal to be inadequate, and the coke becomes very brittle and almost unsaleable.

Whenever managers of gas-works purpose making use of lean coal, the utmost care should be taken to ensure perfect mixing; and therefore it will be necessary that the gas coal should be broken to a size of less than half an inch. In the case of those works which are equipped with mechanical coal-handling plant, the installation of special coal-mixing appliances will be a matter of interest.

# CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

### Dublin Gas Company.

SIR,—As the affairs of this Company will shortly come under the review of the shareholders at the approaching half-yearly meeting, the time is not inopportune to call attention to a few factors relating to the immediate past and their influence on the Company's affairs.

From public records one finds that the gross profits of the concern for the years enumerated are as under:

| | | Price of Gas. |
|---|---|---|
| 1910 | £97,875, or 15·66d. per 1000 cubic feet | 3s. 4d. |
| 1911 | £90,615, ,, 14·91d. ,, ,, ,, | 3s. 4d. |
| 1912 | £92,601, ,, 15·14d. ,, ,, ,, | 3s. 4d. |
| 1913 | £70,484, ,, 11·89d. ,, ,, ,, | 3s. 4d. and 3s. 6d. |
| 1914 | £77,580, ,, 13·38d. ,, ,, ,, | 3s. 6d. |

From this table, it will be seen that the tide has again turned in favour of the Company. The newly-constituted Board have been in actual power for little more than fifteen months. The betterment, therefore, exhibited stands to their credit.

As the Company's affairs, a "technical machine," cannot have become so disjointed and dilapidated suddenly as the finances of the year 1913 revealed, it is reasonable to suggest that the material fall in profits arose primarily through lack of administrative ability; and the period through which the new Board have been in control is more than sufficient to have recovered from this want of administrative and business capacity on the part of the old Board. It is reasonable, therefore, to assume—in fact, it will be seriously disappointing to the shareholders if the half-year's balance-sheet now nearly due does not disclose—a return to the full normal profits at the least, particularly in view of the fact that the Company largely rely on the manufacture of carburetted water gas, so that the high cost of coal will not have been a material hindrance to their prosperity.

In view of the position which the present Board adopted in suppressing the experts' report, shareholders have a right to expect some important communications at the forthcoming meeting. It will be important to know the headings under which the anticipated improvement has been acquired, as distinct from commercial conditions.

It is also very important that the shareholders should be informed of the extent (if any) to which the experts' recommendations, administrative and technical, have been given effect to, and what yet remains to be done. In fact, has the time not arrived when the report might reasonably be circulated among the shareholders—seeing that it would not now affect the credit of the Company, but will be fruitful in allaying much fear and concern as to the Company's future welfare? There should be nothing in the report that the proprietors should not now know; and it is to be hoped that, if the Board show any reluctance to take the shareholders into their confidence, they will be made to do so by the shareholders' vote.

ANTICIPANT.

*Sept.* 3, 1915.

### Radiant Heat Distribution.

SIR,—Your leaderette on the "Distribution of Radiant Heat" claims many advantages for the semi-circular over the straight fronted heating area. It would be better to look for compensations rather than advantages; and they are rather difficult to find.

The straight front—with the radiant energy travelling, of course, in straight lines, but you apparently overlook *in all directions* (not merely at right angles to the front, but sideways)—would effectively warm anyone sitting with the chair on any part of the hearthrug. The radiation unimpeded would strike the side walls of the room a very short distance in front of the line of the gas-fire; no sitter would wish to be behind this line of effective radiation.

The straight front has not been condemned because there is too much heat in the front, so we assume that the semi-circular front would have to give equally as much heat from the front to be effective; to make the sides effective, an increased amount of heat would have to be provided, which means bigger gas bills.

The view at the side would only take in half the heating area; but with the straight front the whole is visible.

One of the reasons why the round-fronted fire has gone out of date (it was all popular at one time) was the difficulty of preventing the products coming into the room every time the slightest draught crossed the front of the fire. It is not possible to protect the front from side draughts, as you can in a straight front.

You will thus see that there are two sides to most questions, including the round-fronted gas-fire (!) which is not new, and is not without defects.

If it were possible to produce radiant energy that would not be subject to the law of inverse squares, the centre of the ceiling would be an ideal place of heating. The heat would be distributed into every corner of the room and not interfere with any of the arrangements as would be the case with central floor heating. We cannot alter the law, as the greatest heat would be at the wrong end of the persons under it.

JAS. W. WILSON
(Wilsons and Mathiesons, Limited.)

*Leeds, Sept.* 3, 1915.

[A reference to this letter appears in a leaderette paragraph on an earlier page.—ED. J.G.L.].

### Atmospheric Gas-Burners—Patent No. 19,073 of 1914.

SIR,—I am interested in this invention; and the inventors may like to know that I made and used discs such as they described five or six years ago. The Ecliptic people have sold high-pressure burners with such discs. If the inventors will communicate with me I shall be happy to show them any of the various combinations. Mr. Franklin Thorp also knows a good deal about such discs.

GEO. HELPS.

*Nuneaton, Sept.* 3, 1915.

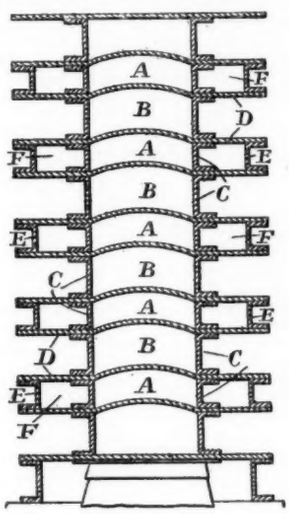
# REGISTER OF PATENTS.

## Built-up Metal Retorts.

DUCKHAM, A. M'D., of Ashtead, Surrey.

No. 13,935; June 9, 1914.

Retorts according to this invention are constructed of steel or iron plates. They are of the kind which are considerably wider than they are deep, and have their sides substantially vertical and the top and bottom arched to the same curvature. The heating flues alternate with the horizontal or inclined retorts in a vertical column. In this case the column can be built up of channel iron bars or beams having the under surfaces of their webs vertical and so placed that the surfaces form the inner faces of the side walls of the retort and of the flues, while the flanges are bolted to flanges of plates of curved cross section which form the arch tops and bottoms of the retorts and of the flues. The flanges of the curved plates may be laterally extended and bolted at their edges to other channel irons "so as to form chambers alongside of the retorts for the reception of the products of distillation."




**Duckham's Built-up Metal Retorts.**

Such a construction is illustrated in vertical cross section through a number of horizontal retorts A with interposed heating flues B. The column is built-up of channel irons C alternating with rectangular plates D. The portion of the plate which is within the space enclosed by the channel irons is arched for the purpose named. The edges of the plates are bolted to channel irons E, so that chambers F are formed —one on each side of each retort—in order that the products of carbonization may be collected from outlets in the sides of the retort.

## Collecting Gas-Main for Coke-Ovens [Retort Benches].

STILL, C., of Recklinghausen, Germany.

No. 14,243; June 13, 1914.

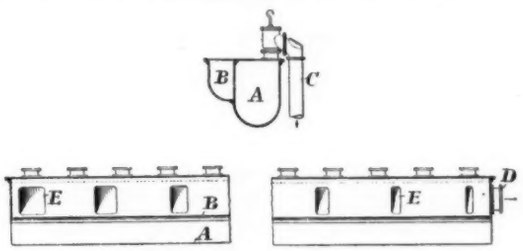
This invention relates to collecting mains for the gases of coke-ovens and the like; the object being "to provide means by which both the pressure at all points in the gas-main extending over the whole length of the oven battery and the suction exerted on all the ovens communicating with the gas-main may be rendered absolutely uniform."

In coke ovens, as usually constructed, the patentee remarks, the gases produced during the coking process are collected in a common receiver—known as the collecting main—extending over the whole oven battery, from which they are exhausted and carried into an adjoining main conduit by suction, which is exerted either in the middle or at the one end of the gas-main. This construction has the disadvantage that the pull on the gases from the different coke-ovens varies according to the position of the latter relatively to the point where the suction is exerted; the intensity of the exhaustion being greater the nearer the oven chamber is situated to this point, and decreasing as the distance becomes greater. Owing to this varying suction, different gas pressures are maintained in the different oven chambers, whereby the tendency of the gases to leak from the oven chambers into the adjacent heating flues, and *vice versâ*, is increased.

The disadvantages named are said to be avoided according to the present invention by providing a special auxiliary gas-main parallel to the collecting gas-main, which latter is connected with the oven chambers by the usual standpipes. The auxiliary main communicates with the collecting main by a series of uniformly distributed openings varying in cross-section in a definite manner, and is itself in connection with the exhausting device which leads the gases away.

A vertical cross-section is given taken through the collecting gas-main and the adjoining auxiliary main; also a vertical longitudinal section through the latter.

The complete gas-main consists of the collecting main proper A and the auxiliary main B side by side with the former. The collecting main, which is closed at both ends, receives the gases from the ovens in the usual way by a number of ascending standpipes C arranged on the individual ovens. The auxiliary gas-main, adjacent to the collecting main, is connected at its one end to the main gas-conduit [not shown] by the pipe D, which leads the gases away to the bye-product plant by the action of any suitable exhausting device. In the partition between the two adjacent mains A and B are a number of openings E, which are uniformly distributed along the whole length of the main, but varying in a definite manner in their dimensions. The opening E, situated nearest to the point D, at which the suction of the gas exhausting device is exerted, must be of the smallest cross-section; while the other openings increase in dimensions as their distance from it increases. By the arrangement of these openings, as described, the distillation gases, entering the collecting main A through the whole series of standpipes C, are exhausted from the main at numerous points distributed along its length into the adjacent auxiliary main B, which leads the gases away in such a manner that very uniform withdrawal of the distillation gases from the different ovens is assured.




**Still's Collecting Gas-Main.**

This effect is said to be realized by dimensioning, according to a certain rule, the different openings E between the two gas-mains A B in such manner that those situated nearest to the end where the gases are withdrawn, and which are therefore most influenced by the suction, are of the smallest size, and those farther from the first are of a size increasing gradually and exactly inversely proportional to the intensity of suction. The uniform exhaustion of the gases from the whole collecting gas-main, and in consequence also from all the ovens connected therewith, "causes the pull on the different oven chambers to be constant and very small, and to approximate closely to that in the adjacent heating flues, whereby a very good working of the coke-ovens is assured."

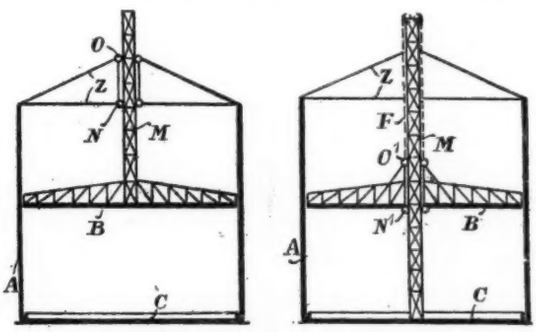
## Gasholders (Erection of) with Disc-Shaped Crowns.

MASCHINENFABRIK AUGSBURG-NÜRNBERG A.G., of Nürnberg, Germany.

No. 16,472; July 10, 1914. Convention date, Oct. 25, 1913.

This invention relates to gasholders with disc-shaped crowns described in patent No. 16,184 of 1914, and relates to an improved method of erecting holders of this type.

Such holders may be erected "with the greatest facility," according to this invention, by using the disc which is intended to serve as the crown as a workmen's platform for building-up the rest of the structure —the disc being for the purpose at first movably suspended and constantly drawn higher as the work of erecting proceeds, and is "finished off as a disc-closing member" only after the work has been completed.




**Erection of "Nurnberg" Gasholders.**

A diagrammatic view is given to show a completed holder erected in accordance with this invention; also a similar view showing the initial stage of erection.

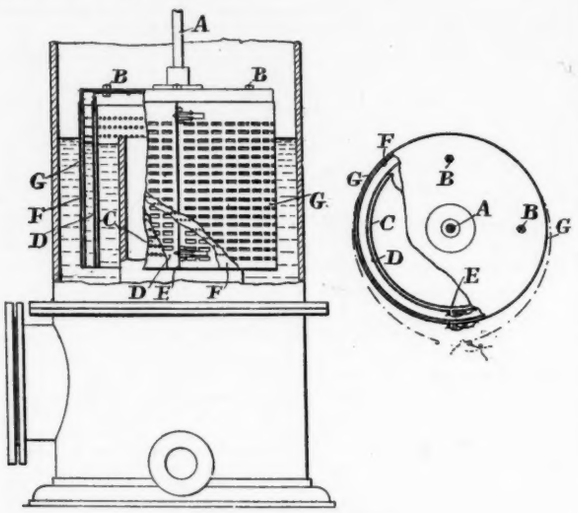
The crown B is guided in a straight line by a column M in a structure Z provided with guide-rollers N. When beginning the work of erection, the supporting framework of the crown B, as well as the column M, consisting of trellis work, is set up on the ground, "without, however, firmly inter-connecting the same." On the contrary, guide-rollers $N^1$ $O^1$ serve for guiding the column and the crown, and are secured to the roof truss Z; being temporarily fitted to the framework of B, so that it can be raised by tackle F on the column (which is anchored at the bottom) and, if necessary, also at the top by ropes. The crown, which is thus adjustable at any height, may be used as a staging for the workmen and as a centring or scaffolding for erecting the sides A. "This arrangement has the additional special advantage that the side wall can be adapted with any desired degree of accuracy to the local inaccuracies in the shape of the disc, so that in any vertical position the room for play at the sealing joint is as small as possible."

## Tar-Separator.

BERLIN-ANHALTISCHE MASCHINENBAU-AKTIEN-GESELLSCHAFT, of Dessau, Germany.

No. 16,981; July 17, 1914. Convention date, Sept. 5, 1913.

This invention relates to tar-separators the plunger bells of which have tar-separating walls, each comprising two perforated partitions or casings, with the object of facilitating the dismantling of the bell for cleaning purposes. According to the invention, the outer casing of each pair of the tar-separating walls is detachably connected, by means of clamping members or the like, to the cover of the bell and to its inner casing or separating wall.




A "Bamag" Tar-Separator.

The plunger bell of the tar-separator shown is secured to a spindle A. The covers of the double-walled bell are detachably connected by screw bolts B. To the flange of the inner cover is secured the inner casing C of the inner pair of walls. This casing is provided with an outer casing D, which bears at the top against the flange of the inner cover, so that only a small space is left between the two casings. The casing is divided vertically along one edge E, and after being placed round the casing C is held by clamps like "bottle-closing devices."

In the same way, the inner casing F (secured to the flange of the outer cover) is provided with an outer casing G, the upper edge of which is divided vertically and bears against the flange of the outer cover, and is also held together by clamps. The two pairs of walls C, D, F, G are maintained apart by distance-pieces—for instance, studs, wires, or the like.

The fixing of the plates in correct position relatively to each other is facilitated by the outer portions of each wall being made in the form of a single closed casing D or G held fast by clamps; and when removing the casings, it is merely necessary to open the clamps, when they can be removed at once, as illustrated by dotted lines in the plan.

## Purifying Gases containing Ammonia and Sulphuretted Hydrogen and Recovering the Ammonium Salts.

DUVIEUSART, F., of Santiago de Chili.

No. 17,475; July 23, 1914.

This invention relates to a process for removing ammonia and sulphuretted hydrogen from gases, consisting in "treating the gases with an aqueous solution of sulphurous acid, the resulting liquor being treated alternately with sulphurous acid and the gases to be purified; further treatment with sulphurous acid and the application of heat resulting in the production of sulphate."

According to the invention, the purification of the gases is effected by washing them, either cold or hot, with a solution containing the sulphited organic bases in tar. This solution is obtained according to the following modes:

1.—By treating tar or crude tar oil with sulphurous acid, and by washing-out the resulting products with water or salt solutions.
2.—By treating a mixture of tar and water, or tar and salt solution, with sulphurous anhydride ($SO_2$).
3.—By treating a mixture of crude tar oil and water, or crude tar oil and salt solution with sulphurous anhydride ($SO_2$).
4.—By treating crude tar oil with sulphuric acid, and by displacing the organic bases by carbonate of soda, and utilizing the bases so obtained for treatment with sulphurous acid and water or salt solutions according to Mode 1.

By washing the gases containing ammonia and sulphuretted hydrogen with the solution prepared in any of the above ways, these impurities are removed from the gases.

The purification of the gases may be effected by liquors so prepared that they are strongly alkaline to methyl orange; but it has been found by the patentee that the most energetic action upon the gases of the prepared aqueous solutions of organic bases occurred when the solution was neutral, or acid to methyl orange, as in these circumstances there is formed (especially at about 80° C.) a large quantity of polythionates, and that the absorption of ammonia and sulphuretted hydrogen was much more rapid. Moreover, it has been found that the aqueous solutions, either hot or cold, of the sulphited organic bases in tar, after having served to purify the gases, and being neutralized by sulphurous acid (neutralization being indicated by methyl-orange) undergo a transformation in the presence of sulphur, a certain quantity of sulphur dissolving in the solution with the formation of polythionates—the liquor ultimately precipitating sulphur and changing gradually into ammonium sulphate. The presence of sulphur is not necessary, it is said; but it renders the transformation more rapid. Nor is it necessary that the liquor should be absolutely neutral in order to arrive at the formation of a sulphate; for even with an excess of sulphurous acid the production of the sulphate is not prevented.

Either before, or on reaching the point of equilibrium, when further formation of ammonium sulphate ceases, or proceeds very slowly, the liquor may be removed for treatment to separate the sulphate. The mother liquor is used again for purifying the gases, or it may be resulphited or not, and brought again into contact with the gases to be washed so as to concentrate the sulphate before treatment to obtain such sulphate in crystalline form, or, again, the liquor may be mixed with fresh solution, after resulphiting if desired—the mixture then being brought into contact with the gases for washing purposes.

After several successive operations, the liquors become sufficiently charged with sulphate of ammonia, and the latter is deposited, in crystalline form, on the hot liquors being cooled. The sulphur in suspension in the liquor is separated by filtration before the crystallization of the sulphate.

## Gasholders.

MASCHINENFABRIK AUGSBURG-NURNBERG A.G., of Nuremburg, Germany.

No. 6109; April 23, 1915.

This is a modification of the invention described in patent No. 16,184 of 1914, with the object of providing packing and sealing means "more efficient in action."

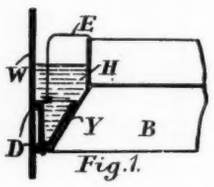



Fig. 1.

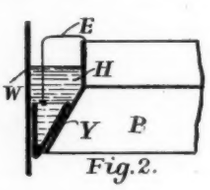



Fig. 2.

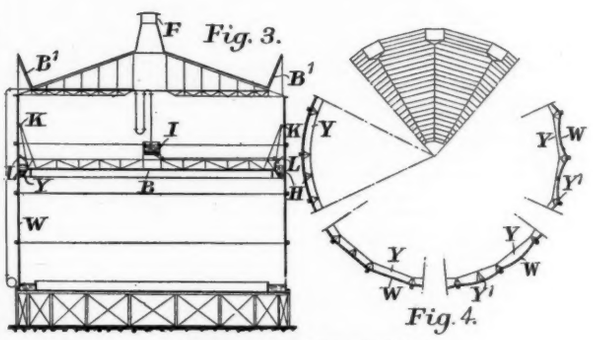



Fig. 3.

Fig. 4.

An Improved Nurnberg Gasholder.

Figs. 1 and 2 are sectional views of two forms of the improved packing. Fig. 3 shows a diagrammatic sectional elevation and a sectional plan of a modified form of the holder.

The packing consists of small metal sliding boxes Y open at the top, which may be provided with packing fillets D (fig. 1), or have smooth walls (fig. 2). Ordinary packing materials—such as strips of felt, jute, leather, metallic gauze, or other metallic packings—can also be laid between the fitting or packing fillets D. The boxes are of wedge-shaped section, connected with the disc B by the holders E, which, if necessary, may be resilient—"being capable of assisting the action of the pressure of the liquid H, or of preventing the sliding pieces from lifting." Between the ends of the sliding boxes, wedge-shaped or pyramidal packing pieces, as described in patent No. 16,473 of 1914, may be inserted. The invention can be employed for holders with and without a roof. If no roof is provided, then provision of draining means of ordinary type must be made, so that water collecting on the disc B may flow off.

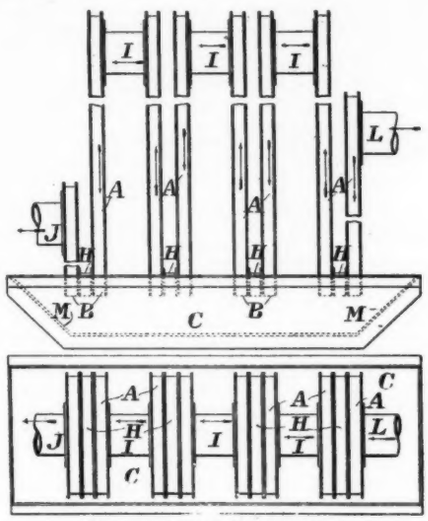
In figs. 3 and 4 an example of the improved holder is shown as composed of flanged sheet metal plate, closed at the top by a roof. The bottom is open, so that the space under the holder may be utilized. The collecting reservoir I, which is intended for receiving the pumped-up liquid, is here arranged on the disc-shaped crown B. It is guided by pairs of rollers K L lying one above the other, which roll either direct on the metal plates W or on brackets [not shown]. The upper guide rollers K, when in their highest position, enter into housings $B^1$ arranged on the roof, so that it is not necessary to make the shell of the holder higher than is necessary with respect to the volume of gas it is desired that it should hold. Ventilation can be effected by an erection F on the roof. This ventilation device can at the same time, when the disc-shaped crown is in its highest position, serve for receiving the flexible tubes which supply the water to the reservoir.

## Condensers for Use in Gas Manufacture.

CLIMIE, W, and LEES, W, of Glasgow.

No. 4264; March 17, 1915.

This invention of "condensers or coolers for use in gas manufacture," particularly relates to the type of "cooler" in which a series of vertical pipes are arranged with their lower ends dipping into a liquor receptacle, as shown in the accompanying diagrammatic elevation, with a plan view of same.




Climie and Lees' Gas-Condenser.

The cooler consists of a series of vertical pipes A arranged with their open lower ends B dipping into water in an open tank. Preferably the pipes are formed by doubling or folding one half of a thin channel-shaped bar over the other half, so that the backs of each half face each other. The sides of the channel bars are covered by side plates so as to form a gas-tight joint—a chamber being thus formed which is open at its lower end and closed at its upper end. The cross section of the chamber is preferably rectangular with a rounded end, so that the gas, in passing through it, is spread out into a thin stream. An opening is formed near the lower end of each pipe in the side facing its neighbour, and a cover-plate H is arranged over the openings and between each pair of pipes. The gas is conducted to the upper closed end of the first pipe by a pipe L, and, passing downwards in the direction of the arrows, strikes the water at the lower end, where it forms a water-seal. The gas now passes through the opening at the lower end of the first pipe, along the surface of the water in the space between the first and second pipes, and through the opening at the lower end of the second pipe into the same. After passing upwards through the second pipe, it is conducted by a pipe I to the third pipe (which is the first pipe of the second pair of pipes), and so on through as many pairs of pipes as desired. The cooled gas is led from the upper end of the last pipe of the series by a pipe J to the scrubber or washer, to be further purified. The tank may be fitted with sloping sides M if desired, and a conveyor chain or the like may be arranged to automatically convey away any deposits in the tank.

## Electric Igniting Apparatus for Gas-Burners.

CARPENTER, C. C., of Old Kent Road, S.E.

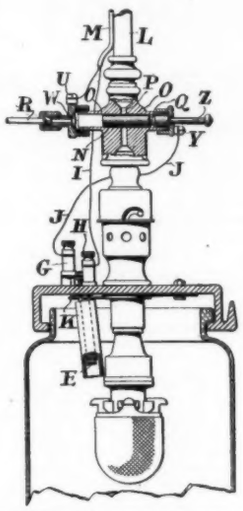
No. 18,504; Aug. 10, 1914.

This electric gas-burner igniter is of the kind in which the gas-tap and the electric switch are retained in a position near the burner and operated pneumatically from a distance. The gas-tap contains an endway movable plug arranged to complete an electrical circuit at the same time that it moves to open the passage-way for the gas.

The invention is illustrated as working an inverted incandescent burner of any well-known type. The hooded filament and the thermostat shown are as described in patent No. 26,156 of 1912.

The gas-tap comprises a metal piston N capable of sliding endwise in a horizontal metal casing O, across which there is a passage P for the gas in a vertical direction. When the gas descending the pipe L meets the full diameter of the piston, it does not pass; but when the piston is moved to bring the reduced portion Q into line with the passage P, the gas travels straight on to the burner. The piston is operated from a pneumatic switch of common construction [not shown] working through a pipe R connected to the end of the casing by a union and coupling-piece. The metal coupling-piece carries externally a terminal U for one of the wires from the electric cable M; but it is insulated from the casing by a collar of insulating material, while within the coupling-piece is a metallic contact spring W, so placed as to contact with the piston N when the latter is moved into a position to permit the passage of the gas. At the end of the casing opposite the coupling-piece is a cap carrying a terminal Y connected by the wire J to the terminal G. The other lead I, from the cable M, connects direct on to the terminal H. Z is an extension on the end of the piston which, passing through the cap, provides means for manipulating the piston directly by hand.

The gas-tap is shown closed and the electric circuit broken. When the pneumatic switch is manipulated, the piston N is sucked towards the left so as to bring it up against the spring contact W and at the same time bring the reduced portion Q into line with the passage P. The effect of this movement is to open the gas supply at the burner and complete the electric circuit of the igniter E at the same time.




Carpenter's Electric Igniter for Gas-Burners.

The reverse movement of the switch returns the piston, cuts off the gas, and breaks the circuit at the contact W, so that, on the cooling of the thermostat K, the circuit will remain interrupted and be ready for a repetition of the operation described.

# LEGAL INTELLIGENCE.

## Complaints as to the Ticehurst Gas Supply.

Uncomplimentary remarks as to the gas supply at Ticehurst were made in the course of a claim at Hurst Green Petty Sessions by the Wadhurst and District Gas Company against a consumer who had refused to pay an account amounting to £4 16s. 2d. The defendant said that for five or six years the consumers in Ticehurst had been complaining about the gas; and the men in his shop had had to leave off work because they could not get enough light. He had also been charged for more gas than he had had. Mr. Alfred Bower, on the other hand, said the present Company had only had the concern since July, 1914; and he was only claiming for the account for the six months from Christmas. Defendant had proved to be a very troublesome consumer. The meter had been changed on several occasions; and an offer had been made to have the present one examined—if found incorrect, the Company would pay the cost of testing. Defendant, however, would not agree to this. Addressing the Bench, defendant said his complaint was that "the consumers had not received gas, but air." The Magistrates decided that they could not take into account the quality of the gas. Defendant must, if he wished, institute other proceedings against the Company in reference to this. The meter registered a certain amount; and they made an order for the payment of the account, with 4s. Court costs.

## Stealing Gas at Manchester.

William Pritchford, a plumber, of Emma Street, Manchester, was charged last Thursday with stealing 100 cubic feet of gas, value 4d., the property of the Manchester Corporation. Mr. A. F. Pickford, prosecuting, said the quantity named was merely a nominal amount, as it was not known how much gas the man had really stolen. At one time, the prisoner was an authorized gas-fitter and plumber on the Corporation official list, but his name had recently been removed. He continued, however, to do odd plumbing jobs, and eventually transformed his workshop into a restaurant. In the basement a prepayment meter was fixed, serving a large cooker and seven or eight lights in the rooms. For some time past the Gas Department officials had suspected that the meter was being tampered with; but it was very difficult to prove that any offence was being committed. However, about 8.45 p.m. the previous day, Chief-Inspector Capon, of the Gas Department, accompanied by two detectives, paid a surprise visit to the premises. Accused was not at home; but his wife was. The wife was told the nature of the errand; but she declined to let the officials see the meter in the absence of her husband. They, however, insisted on seeing it, and it was found that the inlet and outlet had been disconnected, and a supply of gas obtained through a piece of ½-inch rubber tubing. One of the detectives went in search of the prisoner, and brought him to the cellar, where, in his presence, the rubber-tubing was removed, and the meter properly connected up. When the man was charged with stealing the gas, he replied "Guilty." According to the meter card there had been a marked diminution in the amount of gas used at the premises; the accounts being only about one-third of the average of the previous quarters. When the meter was opened, only twelve pence were found in the money-box; these having been put in by the prisoner after being taken into the cellar. In mitigation of the offence, Mr. R. J. Watts said the accused had had serious financial losses; and when his name was removed from the list of authorized plumbers to the Corporation, he sustained a further loss. To some extent the reduction in the amount of the gas accounts was due to the fact that the man formerly used gas in his plumbing business. This, however, had now been given up. Poverty had driven him to commit the offence. Prisoner was sentenced to one month's imprisonment.

# MISCELLANEOUS NEWS.

## FACTORY AND WORKSHOP LIGHTING.

### The First Report of the Departmental Committee.

There was issued at the end of last week by the Home Office, as a Blue-Book, the first report of the Departmental Committee on Lighting in Factories and Workshops. This is accompanied by a memorandum epitomizing the proceedings; and the main portions of this, together with the recommendations and other points contained in the report, will be found below. The Committee were appointed to inquire and report as to the conditions necessary for the adequate and suitable lighting [natural and artificial] of factories and workshops—having regard to the nature of the work carried on, the protection of the eyesight of the persons employed, and the various forms of illumination. The members of the Committee appointed were Dr. R. T. Glazebrook, C.B., D.Sc., F.R.S. (Chairman), Mr. Leon Gaster, Professor Francis Gotch, D.Sc., F.R.S., Mr. J. Herbert Parsons, M.B., D.Sc., F.R.C.S., Mr. W. C. D. Whetham, F.R.S., and Sir Arthur Whitelegge, K.C.B. (Chief Inspector of Factories). At an early stage of the proceedings, Professor Gotch unhappily died; and Professor C. S. Sherrington, D.Sc., F.R.S., was subsequently appointed to fill the vacancy. The Joint Secretaries were Messrs. D. R. Wilson and C. C. Paterson. The Committee met the first time in February, 1913; and 38 meetings have been held.

In the course of their inquiry, the Committee examined fifty witnesses; and a series of appendices to the report indicate the lines on which the investigation was conducted. Occasion may be taken to notice some of the features of these appendices. Meanwhile, it may be stated that among the professional, technical, and scientific witnesses examined were Messrs. J. G. Clark and How (Gas Light and Coke Company), Mr. Albert Stokes (South Metropolitan Gas Company), Messrs. A. J. Whyte and J. Angus (the Keith-Blackman Company), Mr. Franklin Thorp (Institution of Gas Engineers), and Messrs. Haydn Harrison, V. H. Mackinney, and J. S. Dow (Illuminating Engineering Society). Their evidence we shall hope to deal with later. The Committee paid visits to a large number of works in various industrial centres; while experiments on standards of illumination for different purposes were carried out at the National Physical Laboratory. In view of the wide grounds covered by the terms of reference, it was thought desirable to limit the inquiry in the first instance as far as possible to the textile, engineering, and clothing trades; certain general principles, common to all trades, however, being at the same time taken into consideration.

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The development of industrial operations, and the introduction of many new methods of illumination, during the last ten years have served to emphasize the need for statutory requirements relating to the lighting of workshops and factories, similar to those which already exist in regard to heating and ventilation.

The recognition that defective illumination may be a contributory cause to accidents, may be injurious to the health and eyesight of workers, and may exercise a prejudicial effect upon the output and quality of work, has led to general interest in the question of industrial illumination.

The present Committee was appointed "to inquire and report as to the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, having regard to the nature of the work carried on, the protection of the eyesight of the persons employed, and the various forms of illumination."

This memorandum is intended as a brief summary of the principal contents of the report and appendices. Reference to these is necessary for the full appreciation of the reasons which have led the Committee to their conclusions and of the facts on which they are based.

#### Existing Legislation.

For the United Kingdom no general provisions in regard to lighting (analogous to those regarding heating and ventilation) occur in the Factory Acts, although adequate lighting in general terms is included among the conditions to be satisfied in underground bakehouses, and is required in certain dangerous trades. On the other hand, the codes of all the chief European countries, the United States, and India contain provisions requiring adequate lighting in factories.

#### Nature of Inquiry.

The appointment of the Committee in regard to industrial lighting thus marks an entirely new departure in this country. The novel nature of the inquiry entailed special methods of investigation.

In view of the wide ground covered by the terms of reference, it was considered advisable to limit the inquiry in the first instance as far as possible to the engineering, textile, and clothing trades. Evidence was received from fifty witnesses, including H.M. Inspectors of Factories and representatives of various Trade Associations and Scientific and Technical Societies.

The members of the Committee also paid a series of visits to various industrial centres—85 works being visited. In connection with these visits, about 4000 measurements of illumination were made in 163 rooms in 57 factories—the data, as a rule, being prepared previously to the visit. In this way the members were able to form a clear conception of the conditions represented by a certain numerical value for the working illumination, and to compare this with the figures mentioned by various witnesses and found in the existing literature on the subject. Certain experiments bearing on the standards of illumination required for various purposes were also carried out at the National Physical Laboratory.

#### Effects of Bad Lighting.

The inquiry showed that there has been a great advance in methods of illumination; but various defects were met with which are enumerated in the report. In taking evidence and in the study of existing literature, the Committee endeavoured to obtain particulars of the effect of unsatisfactory lighting.

A statistical inquiry into the number of accidents during each month throughout the year points to the conclusion that inadequate lighting is a contributory cause of accident. This is confirmed by the evidence of witnesses regarding accidents in foundries, shipbuilding yards, and cotton mills, and by the statements of the Accident Offices' Association, which embraces most of the Insurance Companies interested in the Workmen's Compensation Act.

Complaints of eye strain, headache, &c., attributed to insufficient lighting are common; and while an exhaustive medical inquiry would be necessary to establish the connection between these defects and inadequate lighting, there is a general impression that unsatisfactory lighting is, in various ways, prejudicial to health. It is also recognized that insufficient light adds to the difficulty of the proper supervision of work, and of the maintenance of cleanliness and sanitary conditions generally.

Witnesses gave specific instances of the effect of improved lighting in increasing the output and improving the quality of work turned out.

#### Recommendations.

From the evidence taken it is apparent that there is a general consensus of opinion as to the economic and hygienic advantages of adequate and suitable lighting. That this opinion is based on experience is shown by the great improvement in lighting which has taken place during recent years, and is still continuing; and in modern factories good lighting is now regarded as one of the most important factors contributing to industrial efficiency. On the other hand, many employers have lagged behind in the general advance. This refers especially to old factories; and it is obvious that any requirement which would tend to bring such places up to the level of more progressive firms would be beneficial not only to the operative, by improving his working conditions, but also to the employer himself, by increasing his output and by improving the quality of the work. Light is a cheap commodity, and little or no hardship should result from such a requirement, if gradually and sympathetically enforced.

The Committee therefore recommend that:

(1) There should be a statutory provision:

- (*a*) Requiring adequate and suitable lighting in general terms in every part of a factory or workshop, and
- (*b*) Giving power to the Secretary of State to make Orders defining adequate and suitable illumination for factories and workshops, or for any parts thereof, or for any processes carried on therein.

It is further necessary to indicate more precisely what is conveyed by the term "adequate lighting." Broadly, the illumination may be said to be adequate and suitable provided that:

- (i) it is sufficient for the proper carrying out of the work both as regards quality and output, and
- (ii) there are no lighting conditions prejudicial to the health, comfort, and safety of workers.

In order to satisfy these requirements, the illumination should comply with the following requirements:

- (*a*) Adequacy.
- (*b*) A reasonable degree of constancy and uniformity of illumination over the necessary area of work.
- (*c*) The placing or shading of lamps so that the light from them does not fall directly in the eyes of an operator when engaged on his work, or when looking horizontally across the workroom.
- (*d*) The placing of lights so as to avoid the casting of extraneous shadows on the work.

The next question is the desirability of specifying the amount of illumination implied in the terms "adequate and suitable." Owing to the great progress that has recently been made in the appliances for measuring illumination (the nature of which is explained in the report), it is now practicable to specify numerical values in a manner that would hardly have been possible some years ago.

It is, therefore, proposed to specify the minimum intensity of illumination desirable, from the standpoint of general convenience and safety in parts of the workshops where work is normally carried on, and in yards, passages, and open spaces along which people are ordinarily liable to pass.

The following four recommendations are made under this head:

(2) Over the "working areas" of workrooms the illumination measured on a horizontal plane at floor-level shall not be less than 0·25 foot-candle,* without prejudice to the illumination required for the work itself.

(3) In all parts of foundries in which work is carried on, or over which any person is ordinarily liable to pass, the illumination measured on a horizontal plane at floor-level shall not be less than 0·4 foot-candle.

(4) In all parts of factories and workshops—not included under recommendation (2)—over which persons employed are liable to pass, the illumination measured on a horizontal plane at floor-level shall not be less than 0·1 foot-candle.

(5) In all open places in which persons are employed during the period between one hour after sunset and one hour before

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* The meaning of the term foot-candle is explained in the report as the illumination produced by a light source of one standard candle at a point of a surface one foot from the source, and so placed that the light rays from the source strike the surface at right angles. Thus if a source of one candle be placed at a height of one foot above a horizontal table, the illumination at the point on the table vertically below the source is one foot-candle. Similarly, with a source of 50 candles at a distance of one foot, the illumination is 50 foot-candles; while if the distance is increased to 10 feet, since the illumination is inversely proportional to the square of the distance from the source, the illumination at the point on the table vertically below the lamp will be 50/100, or 0·5 foot-candle. If the point on the table is not vertically below the source, the obliquity at which the light is incident must be taken into account, and the calculation is less simple; but the illumination can still be expressed in foot-candles. Illumination can, however, always be measured directly by means of suitable instruments without recourse to calculation.

sunrise, and in any dangerous parts of the regular road or way over a yard or other space forming the approach to any place of work, the illumination on a horizontal plane at ground-level shall not be less than 0·05 foot-candle.

These values are suggested without prejudice to the special illumination required for the carrying out of the work, which naturally varies greatly according to the nature of the operations. At present the Committee are not prepared to recommend standards of illumination for these purposes, which require further investigation.

In recommendation (6), provision is made for exemption of individual cases, and of factories to which the above requirements could not be applied; and the case of shipbuilding yards is to receive separate consideration.

Finally, in recommendation (7), suggestions are made for periodical cleaning of windows.

In conclusion, the Committee point out that the minimum values prescribed are considerably lower than those proposed by many witnesses, and are also lower than those found to exist in the majority of factories visited. In many cases manufacturers would naturally prefer to provide a substantially higher value than that indicated. The intention has been to propose values which can be adopted as a practical legal minimum without causing hardship, and would serve the purpose of raising the level of illumination in those factories which are behind modern practice in regard to methods of illumination.

The Committee did not feel justified in drawing any distinction between direct, indirect, and semi-indirect lighting, nor between systems which differ in the colour composition of the light. Similarly, the standards are intended to apply equally to natural and artificial lighting—that is to say, when the natural illumination falls below the prescribed limits, it must be supplemented or replaced by artificial illumination.

The data given in the appendices will be of service to those engaged in designing new factories and in examining the adequacy of lighting in existing buildings. At present there are few collated data of this character available, and the desire not to withhold them longer from publication is a further reason for the submission of a preliminary report at this stage.

Adequate artificial lighting is an important matter in the utilization of factories for night work; and a close connection appears to exist between the lighting conditions and the quality and output of work. The information contained in the report should therefore be of special interest at the present moment, when many factories are working overtime, and preparations are being made for the period of the year when artificial lighting is mainly required.

## EXTRACTS FROM THE REPORT.

### Recommendations.

In submitting our recommendations, we think it desirable briefly to review the circumstances which in our opinion justify us in the proposals we are about to make for the legal regulation of lighting in factories and workshops.

From the evidence taken by us, it is apparent that there is a general consensus of opinion as to the economic and hygienic advantages of adequate and suitable lighting. In support of this, we would refer to Part E. of the "Summary of Evidence" [Vol. 2 of the report], from which it will be seen that H.M. Inspectors of Factories, the experts in illumination, and the representatives of the scientific societies and of the employers' and operatives' associations all agree as to the importance of good illumination and as to the growing recognition of the fact. That this opinion is based on experience is shown by the great improvement in industrial lighting which has taken place during recent years, and is still continuing. In the designing of modern factories, good lighting (both natural and artificial) is now regarded as one of the most important factors contributing to industrial efficiency.

On the other hand, it must be admitted that many employers have lagged behind in the general advance. This applies especially to old factories, designed before the importance of illumination was generally recognized, and to small workshops, on which the occupiers perhaps hesitate to expend the capital necessary for improvement.

It is obvious that any requirement which would tend to bring such places up to the level of the more progressive firms would be beneficial not only to the operative, by improving his working conditions, but also to the employer himself, by increasing his output. Light is a cheap commodity; and little or no hardship should result from such a requirement, if gradually and sympathetically enforced.

Reference has already been made to the evil effects of unsatisfactory illumination. It has been shown that there is evidence of a relationship between accident risk and adequacy of lighting. Complaints as to damage to eyesight resulting from bad lighting conditions are general in character, and specific instances of injury are difficult to substantiate; but there is evidence of the existence of minor ailments and general impairment of efficiency which must eventually re-act on the health of the workers.

There can be no doubt that the degree of comfort in the working conditions is largely determined by the adequacy of the lighting. The visits paid to factories have enabled us to realize not only the contrast between the depressing effect of dark surroundings and the cheerfulness of a brightly illuminated workroom, but also the vast difference in the working lives of the operatives that must result from continual employment under the two conditions. This was made very clear during the experiments with workpeople carried out at the National Physical Laboratory, and also in the course of the observations in factories.

Finally, the necessity of prescribing adequate lighting in factories and workshops has long been recognized abroad; and the industrial codes of all the principal countries contain provisions requiring it in general terms. As has been already stated, definite minimum standards for certain fine processes have been in force in Holland since 1895; and in accordance with the progress of all matters connected with illumination, the original values have recently [1911] been doubled. A minimum standard for general illumination, also, is in force in New South Wales. Several witnesses—some of whom were opposed to the fixing of definite standards—agreed that the virtual omission of any reference to lighting in the British Factory Acts is a serious defect.

In view of these considerations, we feel justified in recommending that a requirement in general terms for adequate and suitable lighting be applied to all factories and workshops. We are fully aware that, until it is possible to define standards, difficulties may arise from time to time in the enforcement of the requirement. Many instances, however, have been brought to our notice, where, without the making of any measurements, it was obvious that the illumination was "inadequate;" and a general provision, such as that proposed, would seem to be essential for the improvement of such conditions.

Precedents for the making of such general provisions exist already in the Factory Acts for temperature [Factory Act of 1901, section 6]:

(1) In every factory and workshop adequate measures must be taken for securing and maintaining a reasonable temperature in each room in which any person is employed. But the measures so taken must not interfere with the purity of the air of any room in which any person is employed.

(2) The Secretary of State may, by special order, direct, with respect to any class of factories or workshops, that thermometers be provided, maintained, and kept in working order, in such place and position as may be specified in the order.

And for ventilation [*Ibid*, section 7]:

(1) In every room in any factory or workshop sufficient means of ventilation shall be provided, and sufficient ventilation shall be maintained.

(2) The Secretary of State may, by special order, prescribe a standard of sufficient ventilation for any class of factories or workshops, and that standard shall be observed in all factories and workshops of that class . . . . . .

In both of these sections, the requirements are expressed in general terms; and, in the case of ventilation, the Secretary of State is empowered to prescribe a definite standard for any class of factories or workshops. Now it is clear that in the case of lighting, while it is possible to make a statutory provision in general terms as to its suitability, it is impracticable to lay down in an Act definite standards as to the amount of illumination required for various classes or parts of factories, or for the numerous processes carried on in them. The requirements applicable to each industry can only be determined after careful inquiry. It is necessary, therefore, if standards are to be established, to give to the Secretary of State power to prescribe these by Order; and we recommend that this be done.

It is realized that the analogy between temperature and ventilation on the one hand, and lighting on the other, is not quite complete. In the first place, temperature, and, to a less extent, ventilation can be expressed in terms, the significance of which is generally understood; and in any given instance "adequacy" or "inadequacy" can be defined by numerical values which are now generally accepted. In the case of lighting on the other hand the unit of illumination, the foot-candle, although fully established and of perfectly definite meaning, is an expression with which few are familiar, with the consequence that in many instances the criterion of adequacy at present consists merely of subjective impressions.

Again, in the cases of temperature and ventilation, convection and diffusion tend to bring about a condition of approximate uniformity throughout the room. Illumination on the other hand has a characteristic value for each separate point, and diversity must constantly exist in the illumination at the different points in the room.

Broadly the illumination may be said to be adequate and suitable, provided that—

(*a*) It is sufficient for the proper carrying out of the work, both as regards quality and output, and

(*b*) There are no lighting conditions, prejudicial to the health, comfort, and safety of workers.

In order to satisfy these conditions the lighting should comply with the four requirements:

(1) Adequacy.

(2) A reasonable degree of constancy and uniformity of illumination over the necessary area of work.

(3) The placing or shading of lamps so that the light from them does not fall directly on the eyes of an operator when engaged on his work, or when looking horizontally across the workroom.

(4) The placing of lights so as to avoid the casting of extraneous shadows on the work.

We are of opinion that the general statutory requirement of "adequate and suitable lighting" should include the observance of the last three conditions, in addition to the provision of an adequate amount of illumination, and that power should be given to secure compliance with them in cases where their neglect clearly renders the lighting "inadequate and unsuitable" in any of the particulars given above. Special emphasis may be placed upon the avoidance of glare, of excessive contrast, and of flickering lights.

As the conclusion, then, of this part of our inquiry, we recommend that:

1. There should be a statutory provision—

(*a*) Requiring adequate and suitable lighting in general terms in every part of a factory or workshop, and

(*b*) Giving power to the Secretary of State to make Orders defining adequate and suitable illumination for factories and workshops or for any parts thereof or for any processes carried on therein.

Standards of Adequacy.—In view of part (*b*) of the above recommendations, we have now to consider the question of the provisions to be embodied in such Orders. We have seen that though the intensity of the light at the working plane is the most important factor of adequacy and suitability, it is by no means the only one; and in making any Order the other factors must receive due weight. Even taking this criterion alone, lighting requirements vary so much that each trade, or even each process, must be considered on its merits, and a standard of anything like general application is possible in well-defined circumstances only.

In cotton weaving, for example, the optimum illumination varies

with the colour of the yarn, the fineness of the yarn, the style of weave, and other circumstances; and a single standard prescribed to cover cotton weaving generally would err in some instances in the direction of prodigality, in others of insufficiency.

This aspect of the question has been touched upon in the course of their evidence by many witnesses, who, while impressing on us the extreme difficulty of framing a regulation to cover all the processes of their trades, agreed in thinking that there might be some requirement specifying a minimum illumination for general lighting to secure the prevention of accidents.

A standard founded upon the numerical value of illumination deals with only one aspect of the problem. It should be used, therefore, by the authorities as a guide to the most important factor in adequate lighting rather than as an exhaustive criterion. It is possible from this point of view to group working conditions in various trades according to the minimum amount of illumination which may be regarded as adequate. This can be done only empirically; and, as has been seen, a large part of the work of the Committee has been devoted to obtaining for this purpose data regarding a few selected trades—viz., clothing, engineering, and textile. The results in full and also summarized are published separately. The summaries are also reproduced in Appendix XV. to the report, and form, we believe, a unique analysis of existing industrial lighting conditions. These observations allow a judgment to be formed as to the average existing practice in this country. But for the present (for reasons given elsewhere) we think it desirable to reserve any expression of opinion as to the minimum amounts of illumination which are needed for special processes.

Leaving thus for the present the consideration of the illumination required for special processes, we proceed to deal with the more general illumination of the factory or workshop as a whole under three heads:

A. The illumination of workrooms or parts of workrooms where work is in progress—that is, of the working area of the factory.

B. The illumination of passages, stairways, lobbies, &c, and places in workrooms or other parts in factory premises over which persons are liable to pass but which are not parts of working areas.

C. The illumination of open yards and approaches.

By "working area" we understand that portion of the floor occupied by, and in the immediate neighbourhood of, the machines, benches, plant, or material, at which the operatives stand or sit in the execution of their work. In this area we include gangways and alleys between or around such working places.

A. *Workrooms.*—The methods of lighting of workrooms may be classified as follows:

(i) General lighting, whereby an illumination is produced which is approximately uniform throughout the whole room;

(ii) Localized general lighting, whereby an illumination is produced which is approximately uniform over a portion or portions of the room in question;

(iii) Local lighting, with the object of lighting some particular portion of a machine or locality by an arrangement of individual lamps acting independently of one another; and

(iv) Combined local and general lighting.

Where general lighting alone is adopted, there is in most instances little risk of the floor of the room being insufficiently illuminated, since the same light must serve also for the carrying on of the work. But with localized general lighting there is always some danger of parts of the room being neglected; while with strong local lighting, the contrast between the brightly illuminated work and the comparatively dark surroundings necessitates careful attention to the general lighting of the room.

Whatever be the light required for the work, it is necessary that the working area should be illuminated sufficiently for obstacles, dirt, and waste to be clearly visible; while in all industries—particularly those in which the work involves danger—it is essential that the general illumination should be sufficient to avoid risk of accidents. Ample illumination for the requirements of the work itself must be provided beyond the minimum general illumination needed.

Information as to the illumination in existing factories is given in the frequency of occurrence curves for floors of workrooms [Appendix XV.] The mid-point, or point above and below which an equal number of observations lie, is 0·45 foot-candle. For the purpose of an Order we have, however, to consider what may reasonably be enforced as a statutory minimum, rather than what is now the average practice, and having regard to this, we recommend that:

2. Over the "working areas" of workrooms the illumination measured on a horizontal plane at floor-level shall not be less than 0·25 foot-candle, without prejudice to the illumination required for the work itself.

Our attention has been called to the special difficulties which would be caused if a ship under construction or repair were considered for the purpose of this regulation as part of the working area of a factory; and we desire, therefore, to reserve for future consideration the question of the illumination to be provided on ships. Special provision also will be necessary for certain workrooms, where the prescribed illumination would interfere with the proper carrying out of some process, such as the manufacture of photographic materials.

The lighting of iron foundries was one of the points under discussion at a conference held in January 1913; but in view of the appointment of the present Committee, no decision was then arrived at. The question whether these should be excluded from the above recommendation, and made subject to a special standard, has received consideration. It appears to be true that the illumination in these foundries is at present below the average of other workrooms. For this there is no justification. On the contrary, the dark surroundings and want of contrast in iron-foundries indicate the desirability of specially good lighting; and we are of opinion that a minimum illumination of 0·25 foot-candle is not sufficient for safety. We accordingly recommend that:

3. In all parts of iron-foundries in which work is carried on, or over which any person is ordinarily liable to pass, the illumination measured on a horizontal plane at floor-level shall be not less than 0·4 foot-candle.

B. *Passages, Stairways, Lobbies, &c.*—For the satisfactory lighting of these, a lower illumination will suffice than in the case of workrooms; since obstacles are usually absent, and the eye is not subjected to the same degree of contrast. Nevertheless, in the course of visits to factories, many instances of defective lighting were noticed, and complaints were received from witnesses on this point, especially in reference to cotton mills. The experience gained from visits to factories, and such observations as we have been able to make, together with the evidence brought before us, indicate that it is desirable to adopt for these places a standard of not less than 0·1 foot-candle. Instances requiring special latitude (such as long passages free from turns and abrupt changes of level, and adequately lighted by the "beacon" system) may be dealt with under recommendation 6. We accordingly recommend that:

4. In all parts of factories and workshops not included under recommendation 2, over which persons employed are liable to pass, the illumination measured on a horizontal plane at floor-level shall be not less than 0·1 foot-candle.

C. *Open Yards and Approaches.*—Here the object of the lighting is to enable a person to see sufficiently well not to stray from the path, and may be compared with that of streets. For any locality where persons are employed at night, and for a path or road to which it is necessary to keep in order to avoid danger—such as an approach leading through a yard containing obstacles—we are of opinion that a minimum illumination equivalent to that of a fairly well-lighted side street (0·05 foot-candle) will be sufficient.

Approaches over clear ground (free from projecting rails or other obstacles and from steps or other abrupt changes of level) where momentary straying from the path involves no risk, and also fenced-in roads, can be adequately lighted by the "beacon" system—namely, the spacing of light sources along the direction of the path at such long intervals that they serve as beacons or guides rather than as means of illumination. These would not be "dangerous parts" in the intended sense of the next paragraph.

In docks, both places of employment and approaches are already subject to a requirement for adequate lighting in general terms. [Regulations for Docks, Reg. 3]. We recommend, in accordance with this precedent, that:

5. In all open places in which persons are employed during the period between one hour after sunset and one hour before sunrise, and in any dangerous parts of the regular road or way over a yard or other space forming the approach to any place of work, the illumination on a horizontal plane at ground level shall be not less than 0·05 foot-candle.

We desire to reserve for a future report the case of shipbuilding yards, which require special consideration, and to which we have not yet been able to devote attention.

Exemptions.—In order to meet exceptional circumstances in which the standards proposed in recommendations 2, 3, 4, and 5 might cause hardship, we recommend that:

6. There shall be power for the Department to allow exemption in individual cases.

Under recommendation 2, for instance, exemptions might be permitted in the case of little-frequented areas which would otherwise come under the designation of working areas.

[After dealing with the question of enforcing the periodical cleaning of windows, the Committee recommend the following general provision:

7. All external windows of every workroom shall be kept clean, on both the inner and outer surfaces.]

## Conclusion.

In submitting these recommendations we realize that the standards proposed by us appear to be lower than the values put forward by various lighting experts who have given evidence before us. Some of the latter referred to the general illumination at the working level, where the values are naturally higher than at the floor-level; and in any case we have felt that they were intended as an indication of ideal conditions, whereas it has been our object to suggest numerical values that can be adopted as a practical legal minimum without causing hardship. It must be remembered that, in view of the diversity of illumination which always exists whatever the system of lighting, any minimum value will usually connote a very much higher maximum and average; so that with a given minimum the efficiency of the illumination depends to a large extent on this diversity. A workroom, for instance, in which the illumination is uniform, and has the value of only 0·25 foot-candle, may be regarded in most cases as very inadequately lighted. We desire, therefore, to point out that none of the recommendations made by us is intended to supersede the requirement of general adequacy and suitability, which, as already explained, depend on several factors in addition to the amount of illumination.

The evidence before us from witnesses and our own observations do not justify us in drawing any distinction in the present recommendations between direct, indirect, or semi-indirect systems of lighting, or between systems which differ in the colour composition of the light. We suggest, therefore, that the standards proposed should be adopted irrespective of the type of lighting. Similarly, the evidence does not justify us in discriminating between natural and artificial lighting; and in the recommendations submitted by us, the standards are intended to apply equally to both—that is to say, when the natural illumination falls below the limits proposed, it must be supplemented or replaced by artificial illumination.

The more specific recommendations of this report may be said, broadly, to deal with the general lighting of factories and workshops—in other words, they have for their object the maintenance in all workplaces of certain standards of illumination primarily intended to ensure the personal safety of workpeople moving about the premises. In the great majority of factories, however, the standards of general lighting suggested here would be inadequate for the actual machines and work benches where the various manufacturing processes are carried on, and local lighting in addition is generally essential. As already mentioned,

we are not prepared at present to suggest values for the minimum illuminations which may be regarded as adequate for special processes.

It was originally our intention to supplement the data already collected for the clothing, engineering, and textile trades, and to extend our inquiries on similar lines so as to include other industries. In view, however, of the present economic disorganization, we think it desirable to submit an interim report of the work already done and to await settled conditions before further prosecuting the inquiry.

The data given in several of the appendices will help those engaged in designing new factories and in examining the adequacy of lighting in existing buildings. At present there are few collated data of this character available; and the desire not to withhold them longer from publication is a further reason for the submission of a preliminary report at this stage.

We are greatly indebted to various firms and private individuals whose assistance has been readily given; and we desire to express to all of them our grateful thanks.

The value of the experimental results detailed in Appendix XV. is due in no small degree to the care and skill bestowed on a difficult task by Messrs. J. W. T. Walsh and G. F. Sedgwick, by whom the observations were made; while the wide knowledge of factory conditions possessed by our Secretary, Mr. D. R. Wilson, and the experience, in questions of photometry and other scientific matters dealt with, of his colleague Mr. C. C. Paterson, have proved of the utmost value. We desire to record our keen sense of the importance of the services rendered by these gentlemen and our cordial thanks for their very efficient help.

(Signed) R. T. Glazebrook (*Chairman*). C. S. Sherrington.
L. Gaster. W. C. D. Whetham.
J. Herbert Parsons. Arthur Whitelegge.

D. R. Wilson, C. C. Paterson } *Joint Secretaries.*

## LEA BRIDGE DISTRICT GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Tuesday, at the Offices, Nos. 63 & 64, Chancery Lane, W.C. —Mr. A. M. Paddon, M.Inst.C.E., in the chair.

The Secretary (Mr. Richard Sandell) read the notice convening the meeting; and the report [*ante*, p. 471] and the statement of accounts were taken as read.

The Chairman, in moving the adoption of the report and accounts, remarked that the former had already acquainted the proprietors with all the more important facts in connection with the state of affairs to be laid before them. It set forth that there had been a satisfactory increase in the sale of gas—particularly welcome at such times as these. It assured the proprietors that they would receive the same dividend as heretofore; and he thought this, in itself, was not a small matter, when judged by the example of other gas companies who had not been quite so successful in this regard. It also stated that a small amount of extra capital had been raised—a fact at which the proprietors would not be surprised—when they remembered that the works were undergoing reorganization on a very complete scale.

### THE ACCOUNTS.

He did not intend to deal with the accounts at any great length. They were not only explicit, but they were presented in exactly the same form half year after half year; and this form was prescribed by the Board of Trade. If, however, there should be any point in them which it might be thought required further explanation on his part, he would, of course, be happy to give the information desired. The revenue account would show them that the Directors had been careful to make the proper apportionments before declaring a profit; and these apportionments must be absolutely staggering to some of those present, when compared with the relatively small apportionments indulged in by some other companies not so very far away. But by doing as their Company did, he felt the Board would earn in an increased degree the confidence of the proprietors.

### WORKING RESULTS.

With regard to the technical and practical side, the expectations which had been formed at the time the reorganization of the works was undertaken had been very largely realized; and it was hoped that the results would be still further improved in the future. But when he told them Mr. Cross had succeeded in selling in the past six months over 13,000 cubic feet of gas per ton of coal carbonized, this would show that they were not very far behind at the present moment. That they should presume to expect an improvement on this figure was characteristic of these days, because even 13,000 cubic feet was far beyond what any company could compass ten or twelve years ago. The unaccounted-for gas was less than 3 per cent., which, again, was, of course, a very good figure. It was really in these refined economies, if he might so term them, that they found their means of resisting the general tendency of evil times, because, as the proprietors knew, all materials were very much dearer now; and although against this fact they had to set-off the increased return from residuals, this would be very far from compensating them for the enhancement of prices unless they could initiate and develop further and additional economies in the processes at the works. And, of course, they had to be careful in their spending—they would all have to be. This was one of the self-evident things the Government had warned them about, among the multitude of things they had not warned them of. The satisfactory financial results which were presented that day were the outcome of all this effort on the part of every department of the Company.

### ADVANTAGES OF GAS.

No doubt, however, those present would be very much more concerned about the future than about the past. On this point he could not altogether re-assure them, because the degree of uncertainty which attached to affairs in a national sense also attached to industrial matters. But looking at things broadly and generally with reference to the gas industry, there was a very great deal to give them heart. In the first place, they might congratulate themselves on the fact that their undertaking was of the character of a public utility; and this meant that if the consequences of the war should press more heavily on the community in the future than at present, very many things would have to be foregone before people could do without gas. In the old days, if anybody was displeased with gas he turned to coal or petroleum; but if anyone turned to coal to-day, he would be relying upon a very, very shaky reed, because coal was so dear that gas at anything like the price at which it was retailed was far more economical to the average person, and vastly more economical to the poor person, than was coal. Of course, their business in the main depended upon the prepayment meter system; and they could be quite sure the poor man who used this apparatus would not be consuming gas to the extent he did if he had not been convinced in happier days that it was cheaper and served his purpose better than coal. And coal at its present price made the advantages of gas very much greater. It was certainly a big benefit to the poor to have such a supply as their Company could give them.

### CHEAP OIL.

While there was the menace of increased coal prices, it must be remembered that, roughly speaking, only about one-half their gas was made from coal. For the remainder, they depended upon oil; and the situation with regard to oil was most reassuring. Oil had never cost them less than it had during the war; and the price had not been raised the remotest fraction of a penny. So that when they reflected that half their supply was dependent upon oil, which they could get in this way without hindrance, it mitigated their anxiety with regard to the question of coal. Then, again, he did not think that oil would go up materially after the war; but it did seem to him that the aftermath of the upheaval would, with reference to the coal supply, be serious to the last possible degree. There was a member of the Board who could probably give them most valuable information on this point; and he thought he would agree that there was very little chance of cheap coal again on the cessation of war. But there was a chance of cheap oil. Of course, nobody was a prophet to-day; and things might not so turn out. But it was necessary to look ahead as far as possible; and this was a reasonable expectation with which they might comfort themselves.

### LOOKING FORWARD.

He did not think they had anything to fear in their district from electrical competition. They had, of course, supported this now for something like twenty years; and by reason of the nature of the district, it was not likely that electricity would do any harm, where the supply was carried out by business methods. They had probably already seen the end of the artificial stimulus which the municipal authorities applied to the supply of electricity in their own interests. Under all the circumstances, he sincerely hoped that, if it was his duty to address the proprietors six months hence, he would be able to present a statement as satisfactory as the one presented that day. The increase of business was still going on; and, as he had mentioned, the new plant was fulfilling expectations, and fresh economies were being brought to book.

Mr. G. W. Carey having formally seconded the motion,

Mr. E. L. Burton congratulated the Board, and the proprietors also, upon the very excellent account which had been laid before them. That it should be possible to show an increase of 2·26 per cent. under the circumstances of the past half year, when the public lighting and outside shop lighting had been curtailed, and when gas lighting had been under other disabilities, was little short of remarkable. Not only had there been this increased output of gas, but the financial figures were excellent. To be able to carry forward almost the same amount of profit as was brought into account, was an achievement which, he thought, very few companies had found possible this half year. The thanks of the proprietors were due in a larger measure than usual to the Board and their officials.

The resolution was then put, and unanimously carried.

### The Dividends.

Proposed by the Chairman, and seconded by Mr. A F. Phillips, dividends were declared (less income-tax) at the rates per annum of 5 per cent. on the preference stock and 6½ per cent. on the consolidated ordinary stock; and it was resolved that £644 be carried to reserve.

### The Work of Officers and Staff.

The Chairman then moved a vote of thanks to the executive officers for their all-important contribution to the results of the half year. He remarked that the proprietors would realize that, in common with those responsible for gas companies throughout the kingdom, their task had been one of anxiety during the period to which the accounts referred. This much went without saying; but there had been anxieties in connection with their own Company which, he was thankful to say, were not general, and altogether abnormal. The outbreak of war caught Mr. Cross just when he was in the state of transition to which he had already referred. They were at the works changing the system of carbonizing from a comparatively antiquated to a new and more efficient one. There was no more trying time in the duties of an executive officer than when a change of this kind was being made; and it was a time at which the highest pitch of results was not looked for. Mr. Cross had, however, not only successfully effected the change, but had done so without sacrificing a jot or tittle of the very high standard that had always charecterized his work. As to the financial side, Mr. Sandell had given the unfailing support which they would expect from his long and devoted service to the Company. He had enabled an issue of capital to be effected in a highly successful manner at a difficult time; and to accomplish this needed experience and tact. And what had been characteristic of the two heads of the departments, had been characteristic of the men all through. The Company had made a very large contribution to the fighting forces. Indeed, they had not a single man who could fight and was not fighting. In the revenue account, it would be seen that there had been expended during the half year £626; and he was sure the proprietors would not grudge a farthing of it, for it was given to the dependants of the men who were at war, and

to help those whom the conditions of war had rendered unable to live on their pay. It amounted to nearly 1d. per 1000 cubic feet; and against all these extra charges the Company had only increased the price 2d., and were, as a matter of fact, only charging 1d. per 1000 cubic feet more than their great neighbour the Gas Light and Coke Company. Though these details applied to the accounts as a whole, they did testify to the efficiency, skill, and devotion of their principal officers.

Mr. A. W. OKE seconded the proposition, which was heartily agreed to.

Mr. SANDELL and Mr. F. W. CROSS briefly responded; the latter pointing out that the unaccounted-for gas should really be averaged over the whole year, as there would be a variation in the different periods. As to the use of gas by the working classes, Mr. Cross said that a single slot-collection [of which they had six in the half year] in certain of the districts into which they divided the area, showed a 30 per cent. increase. This proved the extent to which the working classes were using gas.

Mr. GISBURNE proposed a similar compliment to the Chairman and Directors.

Mr. BURTON, in seconding, remarked that the Board were to be highly congratulated upon the bold policy they were pursuing in the matter of depreciation. They had written off in the capital account £4757, which was equal to 1½ per cent. on the capital. As a proprietor, it was to his interest that this should be done; but he was a proprietor who was not oblivious of the interests of the consumers, and he said in their interests, too, that the policy which the Board were pursuing was a very wise one, and would in the end reflect on the price of gas in an unmistakable manner. When the war was over, and things were again normal, it must have a direct effect in reducing the price of gas, a consummation to which they all looked forward.

The CHAIRMAN'S acknowledgment terminated the proceedings.

## NORTH MIDDLESEX GAS COMPANY.

The Half-Yearly Meeting of the Company was held on Monday of last week, at the Offices, No. 5, Great Winchester Street, E.C.—Mr. A. M. PADDON, M.Inst.C.E., the Chairman, presiding.

The SECRETARY (Mr. E. L. Burton, F.S A.A.) read the notice convening the meeting; and the Directors' report—*ante*, p. 470—and the statement of accounts were taken as read.

The CHAIRMAN remarked that, before proceeding to the formal business of the meeting, he was sure those present who were not already aware of the matter would hear with very great regret of the death of their esteemed colleague on the Board, Mr. John Heal. As long ago as last April, Mr. Heal was the victim of a street accident, and died shortly afterwards. He was elected a Director in 1877, so that for 38 years he had occupied a position on the Board. He (the Chairman) could speak of him from personal knowledge for the last 21 years; and he could assure the proprietors that during all this time his contribution to the administration of the Company was a most valuable one. He had known the undertaking almost from its inception; and as a local resident, he had a singularly intimate knowledge of those matters which affected the prosperity of a company in its particular area. Mr. Heal had been succeeded on the Board by Mr. A. F. Phillips, who occupied in many respects the premier position among gas engineers of the day; and when a company of the size of theirs, with the very small inducement they could offer him, were able to secure a Director of this stamp, it was unnecessary to emphasize the advantage it constituted to the Board and the proprietors. As to the report and accounts, it would be realized with satisfaction that, so far as they had gone across the sea of trouble since the commencement of the war, the Company had suffered very little loss, and experienced very little derangement in the conduct of the business. There had been a small increase in the sale of gas for the half year; and this was more than they could legitimately expect, because they did not share in any of those activities attaching to the organization of war. They had no industries which developed to a high degree. It was a residential district; and, as such, they were mainly influenced by the curtailment of the incomes of those whom they supplied, so that they might fairly have expected a decrease. The report explained very much what they knew already with regard to the atmosphere of general difficulty; and the significant fact was that it had been necessary to raise the price of gas 2d. per 1000 feet. The benefit of this had only accrued from the end of March; so that the increase, which was not a large one, had had a very small effect on the figures. They would agree that it was quite a modest rise to demand from the consumers; and the Directors were not without hope that they might be able to get through the difficulties before them without still further enlarging it. After having brought the profits resulting from the past six months into account, and disposed of them according to the necessities of the occasion, they carried forward a slightly reduced amount to the next account—the difference between £4662 and £3967. Finally, the report stated that there had been raised £17,500 by the issue of additional ordinary shares, which had been passed to the credit of the capital account. This in itself was a matter for congratulation. The issue was, of course, made some time after the war began; and the money was raised at slightly under 5½ per cent. This showed that the credit of the Company was good, and it also showed that they were indebted to the Secretary for the fact that the issue was conducted with skill and circumspection. In the capital account there were two sums of £18,491 and £28,950 yet to be issued; and it was shown that the total capital received for the purposes of the undertaking was £213,398. This brought the capital per million cubic feet of gas sold per annum to £697, which was very much higher than it had been for some years past, and also much more than he cared to see in the accounts. But the works had been brought up to the highest pitch of modern efficiency. There were no works in the kingdom conducted on more improved technical principles than were their own to-day; and, of course, this brought its fruition into the revenue account, by reason of the margin of profit which would declare itself later. It would be seen that coal had only cost £123 more, in spite of the increased sale of gas. With regard to the items in the revenue account for the repair and maintenance of works and plant, mains and service-pipes, meters, and stoves and fittings, which comprised the amounts allotted to depreciation, these showed that there had been so expended a sum equal to nearly 14d. per 1000 cubic feet, before the declaration of any profit. Then there was an item of £484 for allowances to dependants of employees on active service, which amounted to another ¾d. per 1000 feet. These were very large sums to take out of the revenue account, before coming to the question of profit. In bad debts there was a big increase at £343, which was ½d. per 1000 cubic feet. This did not represent bad debts actually incurred; but the Board recognized that they were passing through a time in which they must look for an amplification of this item, so had apportioned a certain amount in anticipation of troubles to come. This seemed to him a prudent policy to adopt, where it could be done. After all this, the balance carried to profit and loss amounted to £5584, which was £676 less than a year ago; and it was also, incidentally speaking, £694 less than was required for the purpose of dividend and other charges. Out of 200 men in the employ of the Company, 53 were serving their country, having joined one or other of the branches of the fighting forces. He therefore felt certain that the proprietors would approve of the expenditure voluntarily undertaken with regard to their dependants at home. ["Hear, hear."] In the general balance-sheet, it was stated that there had been expended on alterations to, and renewal of, works and plant £2500. This was a suspense account—a thing they none of them liked. But in this half year they had reduced the amount by £1000 out of profits. That was to say, six months ago it was £3500; and by reason of the charges to revenue they had reduced it to £2500 in one half year. This would, at all events, convey the impression that they had the residue very well in hand. The reserve, insurance, and renewal funds had all been written-down. They carried forward in the reserve fund £17,723. This represented the value of the investments written-down to the Government minimum, and therefore the actual value of the fund as it stood to day. The same thing applied to the other two funds he had named; so when they appeared in the next statement they should preserve their proper relation to actual values, unless there should be further depreciation meanwhile. From the benefit fund account only £5 had been disbursed in the half year; but the revenue account had contributed £158. It was certainly advisable to keep this fund at the respectable figure of £739, because then they would be able to suspend contributions to it for a period, if times became leaner still. As showing the efficiency of the manufacturing operations, he might state that they sold 13,112 cubic feet of gas per ton of coal carbonized; and the gas used on works and unaccounted-for was 6·37 per cent.—a perfectly justifiable figure for a company like theirs, where the three centres of consumption were all removed from each other. Now, with reference to the future. He could only say they had a very large stock of coal. Contracts had been made as far ahead as possible, and on no worse terms than those offered to their neighbours. They had also a big stock of oil, which was being obtained at a low price. In these matters, they could see their way for six months ahead; but, of course, with regard to circumstances generally, they could not tell what was before them. They had, however, thought of everything possible, down to insuring their works against aircraft. He concluded by moving the adoption of the report and accounts.

Mr. H. A. LERMITTE seconded this; and it was carried.

Mr. J. H. WARDEN moved, Mr. F. R. SMITH seconded, and it was agreed, that the sincere regret of the meeting be conveyed by the Secretary to the relatives of the late Mr. John Heal.

On the proposition of the CHAIRMAN, seconded by Mr. H. F. LOFTS, dividends for the half year were declared, less income-tax, on the preference capital at the rate of 5 per cent. per annum, on the original ordinary capital 11 per cent. per annum, and on the additional ordinary capital £7 14s. per cent. per annum.

The CHAIRMAN, in proposing a hearty vote of thanks to the Secretary, Engineer, and staff, said the very excellent figures he had quoted in Mr. Trewby's department showed how well the works were being carried on as regarded carbonizing. His results in the matter of fuel were just as good. He was getting a percentage of coke equalled by very few works—11½ cwt. per ton clear of the retort-house, and coming into account. The returns from sulphate of ammonia were singularly good; and altogether Mr. Trewby was serving the Company admirably. As to Mr. Burton, he had had to the full his share of the difficulties.

Mr. JOSEPH CASH, in seconding, said he could sympathize with Mr. Trewby on the way in which he had had to carry on during the past half year under special difficulties. The working was excellent.

The motion was cordially passed, and briefly acknowledged by Mr. LAWRIE TREWBY and Mr. BURTON.

A similar compliment to the Chairman and Directors, on the proposition of Mr. SMITH, seconded by Mr. W. G. BEAUMONT, brought the meeting to a close.

## WORTHING GAS COMPANY.

The Half-Yearly Meeting of the Worthing Gaslight Company took place on Saturday week—Mr. H. H. GARDNER presiding. The report and accounts [see *ante*, p. 415] were submitted.

The CHAIRMAN stated that £5000 more stock had been issued, realizing a net sum of £4677. The expenditure on capital account had been £6554; and there had been written off for depreciation of meters, stoves, and fittings £1479, making the net increase of capital £5075. This account, therefore, stood at a total of £147,628. Dealing with the revenue account, the Chairman said the expenditure on coals was £11,320, as against £9655 in the corresponding period of last year—an increase of £1664, which was accounted for partly by the increased quantity carbonized, and partly by the increased cost of coal through their inability in the early part of the year to obtain deliveries of the coals contracted for, resulting in compulsory purchases of inferior coals at a considerably increased price. They had had an anxious time, but (he was glad to say) did not fail with the supply of gas; and in spite of all their troubles they had earned their dividend. The

total manufacturing charges showed an increase of £1369. On the receipts side, gas sales showed an increase of £844, notwithstanding a reduction in public lighting of £499. The balance to the credit of the revenue account carried forward to the profit and loss account was £4383, as compared with £3372 at the corresponding period, or an increase of £1011. The balance now standing to the credit of the profit and loss account and available for dividend was £23,809. The Chairman announced that the new gasholder at Goring was now completed, and would soon be in use. It would prove a valuable addition to the Company's plant, and relieve some of the anxieties of the management. He also made an interesting statement as to the important part the Company had played in helping to meet one of the nation's greatest needs, and added that it would be well for the public to adopt gas for heating and cooking as far as possible during the coming winter, not only because there would be a probable shortage of other fuel, but for reasons connected with the war. Having regard to the difficulties he had mentioned and to war conditions, stringent lighting orders, and the fact that so many of the staff had left to serve their country, they could congratulate themselves on the general working results.

The report having been adopted, a dividend was declared of 5 per cent. per annum (less income-tax) on the consolidated ordinary stock.

Mr. S. O. STEPHENSON (the Manager), replying to a vote of thanks to the staff, said they had been working under such circumstances of difficulty as he had never known before; and they would deserve all the sympathy and support they could get from the consumers in the near future. He referred to the important help they had been able to give to the Government; and on this account he asked for the indulgence and co-operation of the consumers.

## BARNET DISTRICT GAS AND WATER COMPANY.

### High Make of Gas per Ton—Small Increase in Price.

The Half-Yearly General Meeting of the Company was held yesterday week, at the Holborn Restaurant, High Holborn, W.C.—Mr. ARTHUR F. PHILLIPS, M.Inst.C.E., in the chair.

The SECRETARY (Mr. Ernest W. Drew, F.C.A.) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN, in moving their adoption, said the business during the half year had only been carried on with considerable anxiety. The cloud of the awful war continued to overshadow everything; and rendered it difficult to obtain supplies and material necessary for the manufacture and distribution of gas. In the early part of the year, it was difficult to procure coal. The supply at the collieries was short; and the prices demanded were exorbitant. There was also consider able delay in transit; the claims on the railways for the conveyance of war material being so considerable that ordinary traffic had to stand on one side. There was further trouble on account of labour—some of the best and most able men joined the Colours; and those who remained demanded an addition to their wages to meet the increased cost of living. Fortunately, the Company had just introduced retort-charging machinery, by means of which the number of men required to produce the gas was greatly reduced. The result of this was that, notwithstanding these troubles, the cost of labour on the gas-works was slightly below that of the corresponding half of last year. While speaking of labour, he might mention that the Company had not lost so many men to the Colours as some works—probably through having older men in their employ. Of the total number of workmen 21 per cent., and of the office staff 40 per cent, had joined the country's forces. The gas made during the half year amounted to 102,866,000 cubic feet—only a slight increase on the corresponding half of 1914, when it was 101,718,000 cubic feet. The increase would have been larger had it not been for the reduction in consumption for public lighting, and for the suppression of outdoor shop lamps. The make of gas per ton of coal was 14,076 cubic feet, of which 13,295 cubic feet were sold. The coke for sale was 10·37 cwt. per ton of coal. Such results were evidence of most satis factory carbonizing. In the water undertaking, the quantity of water supplied was 402,657,000 gallons—an increase of 21,096,000 gallons on the corresponding half year. Reverting to the gas undertaking, he said that last year at Lady-day, the price of the gas was reduced 2d. per 1000 cubic feet. This year as from Lady-day, to meet the great increase in the cost of coal and other material, the 2d. had had to be reimposed. The Directors hoped, with this slight addition to the price, to be able to meet all requirements. There was on this occasion no addition to the capital account of the gas undertaking. All that had happened was that, while an amount of £23 had been spent on mains, &c., there was a credit of £90 for a small strip of land sold to the Railway Company to adjust their boundaries—thus causing the capital account to show a diminution of £67. In the revenue account, coal, oil, and coke for gas manufacture cost £7560, against £6848—the difference being due to the higher prices paid for manufacturing materials. Wages amounted to £1036, against £1054. Repairs and maintenance of works had cost £1642, as compared with £1898. On repairs and renewal of mains and services £666 was expended, against £1014. Public lamps cost £511, against £393. All the other expenses were much the same as in the previous half year. The receipts for gas totalled to £15,894, as compared with £15,889—only £5 more. It must, however, be remembered that the price of gas for the Lady-day quarter was 2d. per 1000 cubic feet lower than in the previous year, and that the price was 2d. higher for the quarter ending Midsummer last than in the Midsummer quarter of the previous year. Coke yielded £2755 against £2670, though the prices that could be realized for it in the Company's district were not so good as those obtainable in some other companies' areas. The market for tar was bad. This product only realized £421, against £856. The receipts for sulphate of ammonia were £564, as compared with £463. The result of the half-year's working of the gas undertaking was a falling-off of the profit from £4584 to £4061, showing that the Directors were justified in raising the price of gas by 2d. The capital account of the water undertaking showed additions of £288 for further land and £64 for mains and services, making a total of £352. The expenditure on water revenue was nearly the same as in the corresponding half year—totalling to £9184, as against £9171. The water-rental showed little increase; totalling to £24 493, as compared with £24,300. But this was not to be expected, seeing that there had been little or no building or development proceeding in the district since war was declared. The resulting profit on the water undertaking was £15,393, against £15 210. It would be seen from the profit and loss account, that 100 guineas was contributed to the National Relief Fund; and £2000 was transferred to the contingency fund. After providing for income-tax and interest on loans and debentures, there remained a balance of £36,748. The proposed dividends would absorb nearly £13,300—leaving about £23 450 to be carried to the current half-year's accounts. The future was full of anxiety; and, while the awful war lasted, it was impossible to say what the Company might have to contend with. Every possible precaution was being taken to hold good stocks of coal and other material; but who could say what labour difficulties there might be in front? The demands that the continuance of the war might make upon labour might be serious, and the needs of the nation must be met. He (the Chairman) had recently visited all the Company's pumping-stations and the gas-works, and could assure the proprietors that everything was in the most efficient state, and capable of meeting all probable requirements. In conclusion, he said the Directors considered it advisable to insure the gas and water works against damage by aircraft; and this had been done with the Government.

Mr. ALFRED LASS seconded the motion.

Mr. L. ANDREWS congratulated the Chairman and Directors and the proprietors on the position of the undertaking. He had looked through a good many balance-sheets of gas companies this half year; and he must say that this one showed sound direction and good management.

The motion was unanimously carried.

Proposed by the CHAIRMAN, and seconded by Mr. SAMUEL CUTLER, dividends were declared (less income-tax) at the rates per annum of 9 per cent. on the "A" and "C" stocks, 8 per cent. on the "B" stock, and £6 6s. per cent. on the "D" capital (gas and water) stocks.

The CHAIRMAN moved a vote of thanks to the Engineer and Manager (Mr. F. J. Bancroft), the Secretary (Mr. E. W. Drew), and the other members of the staff, for their services during the half year. He remarked that in his opening address he had alluded to the excellent work Mr. Bancroft had done in the gas-works; and he could assure the proprietors it was equally good in the water-works. If any of the proprietors at any time happened to be in the neighbourhood of Tyttenhanger, and paid a visit to the pumping-station there, they would be able to form some idea of the excellent work that Mr. Bancroft did, and the care with which he expended the capital of the Company. They were also much indebted to Mr. Drew for the way in which he kept the accounts, and the satisfactory manner in which he carried on the general business. The whole of the members of the staff had served the Company most loyally during the half year.

Mr. H. G. HILLS, in seconding, observed that, notwithstanding the difficult times (as described by the Chairman) through which they had been passing, the proprietors were receiving good dividends. While congratulating themselves upon this, they could most heartily thank the officers of the Company for what they had done for them.

The motion was cordially passed.

Mr. BANCROFT, replying for his staff and himself, said he appreciated very highly the kind words used by the Chairman in reference to his (the speaker's) work and that of those working with him. Those in authority in gas and water undertakings had never had to work harder than now, nor had they ever had such anxious times as those through which they had been, and were now, passing.

Mr. DREW also thanked the Chairman and proprietors for the kind words used, and so heartily endorsed. They would be highly appreciated by every member of his staff as they were by him.

Mr. ANDREWS, in proposing a vote of thanks to the Chairman and Directors, remarked that it said a great deal for the management of this Company that the proprietors were receiving such good dividends, while some other companies had had to largely reduce theirs. As to the increase in the price of gas, he noticed that all the Directors had had to do was to put on again the amount that was taken off twelve months ago. This was very satisfactory. All the proprietors had the greatest confidence in their Board.

Mr. HILLS seconded the motion, which was heartily agreed to.

The CHAIRMAN, in expressing the appreciation of his colleagues and himself, said there might be troubles in front; but the proprietors might rely upon the Board doing their best to meet them.

## MANCHESTER ELECTRICAL DEPARTMENT.

### Defence of the Policy of the Committee.

Only a sparse attendance of the members of the Manchester City Council were present at the monthly meeting last Wednesday. Chief interest centred in Mr. Ross Clyne's proposal [*ante*, pp. 256, 471], asking for the appointment of a Special Committee, and an independent expert, to inquire into the policy of the Electricity Department.

Mr. ROSS CLYNE (who is a member of the Gas Committee) delivered a long speech, in the course of which he animadverted upon the policy of the department. He criticized the intention of the Committee to build the largest generating station in the world at Barton, at a cost of over half-a-million of money. He considered that the business of the Committee was not done as it should be. The Council, he said, had been kept too long in the dark regarding the working of the scheme. It was stated that the new station would be required at the end of the war, for the needs of the city. He, however, was afraid they were going to have a "white elephant" upon their hands. In this matter there was a clash of interests. He complained that a large sum had been spent in costs, without the permission of the Council. Things were done by the Electricity Committee which would not be tolerated by a private venture. There were, he alleged, secret dealings with members of the Committee and large firms which the rank and file of the Committee knew nothing about. He mentioned this at the Local

Government Board inquiry held in Manchester into the proposed new electricity station. The Corporation should spend money as they would spend their own; and he contended that the Electricity Committee had not done this.

Mr. PIERCE, who seconded, contended that some things at the electricity station were obsolete. The Committee had put nothing aside for renewals.

Alderman WALKER (Deputy-Chairman of the Committee) pointed out that Mr. Clyne was at one time a member of the Committee; but he failed to attend one-half of the meetings. From time to time the fullest information was given as to the policy adopted; and large majorities of the Council had supported this policy. Committees of the Houses of Lords and Commons had passed the scheme; and the Local Government Board had sanctioned it. The increased demand for electricity had enabled the department to make huge strides, notwithstanding statements to the contrary. Firms engaged in the manufacture of munitions had stated in writing that very serious harm would be done if the new scheme was not gone on with. Only a few weeks ago an Inspector of the Local Government Board had visited Manchester to see where further curtailment could be made in municipal expenditure; and it had been decided that these new works were necessary, and that they must be proceeded with. At present their resources were being strained to the uttermost; and in erecting a new station, the Committee were bound to go where there were millions of gallons of water available—on the Manchester Ship Canal. The reliability of the electricity service had been the means of bringing new industries to the city.

Mr. Clyne's motion was lost—only two hands being held up for it.

## STOCKPORT CORPORATION GAS DEPARTMENT.

### Capital and Expenditure.

At a Meeting of the Stockport Town Council last Wednesday, Mr. HENRY BELL, D.C.L., J.P. (the Chairman of the Finance Committee), moving the adoption of the various accounts of the Corporation [an abstract of which had been prepared by the Borough Treasurer, Mr. H. Grundy], took the opportunity of replying to the contention of Alderman Graham, in reviewing the gas accounts at the previous meeting, that it was not wise, when capital was required, to obtain it by further borrowing, inasmuch as they were thereby building-up the capital debt and increasing the burden which the town had to meet. In one sense, said Mr. Bell, they did this; but it must be remembered that they paid back some of the outstanding debt every year. There had altogether been £524,037 spent on gas; and the total capital owing was £243,959, or less than one-half the amount expended. It was also contended that capital expenditure should be borne to a large extent out of revenue. The Gas Department had raised and paid £156,376 towards capital expenditure. The capital debt owing last March was £3907 less than it was twelve months ago, in spite of the fact that £7872 additional capital expenditure had been incurred during the twelve months. As to the benefit to the ratepayers from the capital invested in the gas undertaking, it was shown to be 1¼ per cent. Some people said it should be 5 per cent. The return to the ratepayers on the capital sunk in the electricity undertaking was only 1¼ per cent.

Alderman FERNLEY (an ex-Chairman of the Gas Committee) seconded the motion, remarking that, as compared with similar towns, Stockport stood very well indeed financially.

Mr. ROYLE wondered how it came about—not professing to be a financier—if the town was in such a good position, that there was any necessity to increase the rates, and put 6d. per 1000 cubic feet on the price of gas.

Mr. BELL observed that Mr. Royle's remarks had reference to revenue. Every Committee required more money for the year's work; and there was less to be given from the profits of the Corporation. Therefore the balance was bound to be made up by the ratepayers.

The Council approved minutes of the Gas Committee which contained the terms of settlement of a recent minor dispute, and alluded to a joint application made to the Board of Trade by the Corporation and the Municipal Employees' Association for the appointment of a practical person to examine and adjust the wages in the Gas Department.

## PROPOSED INCREASE OF PRICE AT WIGAN.

The minutes of the Gas Committee presented at the monthly meeting of the Wigan Borough Council led to a long discussion, owing to a divergence of opinion regarding the extent to which it would be advisable to increase the price of gas. By a majority the Committee had agreed to recommend an increase for all purposes of 8d. per 1000 cubic feet; but two members voted that the rise should be 9d.

Alderman ANGUS, in moving the adoption of the minutes, said the outlook for the gas undertaking for the next twelve months looked very serious; and it was likely there would be a deficiency through increased expenditure and reduced receipts of something like £16,000. It was, however, estimated that they might get from coke an extra £3000, and £1000 from sulphate of ammonia; but they hoped to get more. This left a total increase of £12,275 to be provided for over the estimates. Now there were only two ways in which they could hope to get the money. One was by asking the ratepayers to allow it to go on the rates, and the other was to increase the price of gas. Probably some of them might say that the rates had benefited by the profits of the Committee in years gone by, and that it was only natural, now there was a deficiency in this abnormal year, that the rates should be used to help them out of the difficulty. The Committee, having carefully considered the matter, wanted to be fair to the Council and to the town, and to say that, though in the past they had given money to the relief of the rates, as now constituted the Committee had no intention of giving any more. Their intention had been, had times been normal, to reduce the price of gas according to the profits made, so that the small consumer should have the benefit. Seeing this was their intention, they thought it was hardly fair they should come to the ratepayers and ask them to meet the deficiency. They asked the public to bear with them in such an abnormal year—because they hoped it would not last more than a year—and he would give the promise to consumers that in future they would get the benefit of a reduced price for gas according to the profits that were made. The increase in the cost of coal was 4s. 9d. per ton, which on 38,000 tons amounted to £9025. The increased cost of gas oil was £1000; sulphuric acid, which was used to make sulphate of ammonia, £400; increased wages, £350; iron, lead, and other stores, £350; war allowances to soldiers' families, £50; war bonus, £650; reduced consumption of gas, £1500. He did not know how the last item would work out, because the reduced consumption was brought about by the street lighting. The reduced revenue from tar was £1000. Wigan was in a fortunate position, in that their contracts for coal did not expire until late in the year. It was thought, and even said, by some people, that the Committee had made a mistake in allowing things to run so late in the season before they made their contracts. They had not made any mistake; but, on the other hand, they had saved the town hundreds of pounds. Wigan was not the only town in difficulty, because he had a list of places before him where the price of gas had already been raised from 5d. to 9d. per 1000 cubic feet. They proposed to increase the price of gas in Wigan by 8d., with the promise, as he said before, that when they found they were making a profit they would give it back to the consumers.

Mr. BAUCHER, in moving an amendment that the minutes be confirmed with the exception of the one relating to the price of gas, urged that the figures submitted in favour of a rise of 8d. required further consideration. The gas-works as a whole, he said, needed overhauling; and he wanted the Committee to go thoroughly into the whole position. They should face the worst now.

Alderman DICKINSON seconded the amendment, because he believed it was not a safe business proposition to only raise the price 8d. They all deplored the position of the Gas Department; but they had to face the matter as they found it. He asked the Manager (Mr. F. Betley) what he thought would cover the deficiency for twelve months; and he said: "At least 9d." It was known and discussed by the Committee that 8d. would leave a deficiency of between £2000 and £3000, which it was suggested should be taken out of reserve. It was their duty to see that the Gas Committee cleared themselves without calling upon the rates; and by taking the matter back, some means might be devised which would effect their object.

Alderman ANGUS said the Committee had no objection to the minute going back; but they did not like nasty statements being made.

The minutes were then approved with the exception of the paragraph referred to.

## OLDBURY GAS-WORKS ACCOUNTS.

The statement of accounts of the Oldbury gas undertaking for the year ended March 31 was issued last Friday by the Manager (Mr. C. H. Carder).

On loan capital account, the total amount borrowed to March 31 was £85,399. There has been repaid £28,516, leaving £56,883 outstanding. The quantity of gas consumed was 148,245,800 cubic feet; the total sales amounting to £17,098. There was received £1293 for public lighting and under contracts; and the residuals realized £5391. Discounts and allowances were £828, making the income from all sources £23,093. The total expenditure was £21,708, leaving a gross profit to be carried to profit and loss account of £1385.

The accounts will be considered at the October meeting of the Council.

## METER REPAIRS AT BLACKBURN.

### Works to be Utilized for Munition Making.

The Blackburn Town Council at last Thursday's meeting discussed a proposal of the Gas Committee to reduce the staff of meter repairers at the Jubilee Street works from twelve to three, and to devote the premises to the making of munitions.

Mr. BATES, on the matter coming up, asked whether the Chairman of the Gas Committee (Alderman Nuttall, J.P.) was aware that nine out of the twelve meter repairers who were trade unionists had been discharged, and that the three retained were non-unionists.

Alderman NUTTALL said the three men were retained because they were the oldest men, and not likely to get jobs elsewhere. The others were all capable and were able to get work—particularly on munitions. Mr. Morton Fyffe, the Gas Engineer, had promised to take them back at the first opportunity.

Mr. E. PORTER (the local Secretary of the Gas-Workers' Union) moved to refer the minute back. He said it was not understood in Committee that devoting the premises to munition work meant the discharge of workmen. It had been shown that money was saved by the Committee doing their own meter repairs; and to discharge nine men from the place meant sending work out of the town and incurring additional expense.

Mr. BATES, who seconded, said that Mr. Fyffe, in his interview with a deputation, had expressed the opinion that three men could do the meter-repairing in Blackburn, and added that he was not sure that it would not be cheaper to send the meters away for repair. Humane considerations might have influenced Mr. Fyffe in retaining the services of the older men; but younger men with wives and children were also worthy of consideration.

Sir EDWARD HAMER (the ex-Chairman of the Gas Committee) said that if, as stated, three men could do the work of twelve, it pointed to some mismanagement in the past which should be inquired into. Was this a move to get the meters sent out of Blackburn for repair; and, if so, was it an economical policy?

Alderman NUTTALL characterized Mr. Bates's version of what had occurred at the interview with Mr. Fyffe as "totally untrue." He

denied that Mr. Fyffe had discussed the points with Mr. Bates—the whole statement was a fabrication, as Mr. Fyffe was not in a position to say whether it would be cheaper to send the meters out of Blackburn for repair. The nine men, the speaker added, were not being dispensed with with any such idea; and though it was true that their week's notice expired that (Thursday) night, they were told that it would not take effect probably for three or four weeks.

After the Town Clerk had explained that the passing of the Gas Committee's report would not prevent them giving consideration to the position of the men, and endeavouring to find them employment, the report was adopted.

## ZÜRICH GAS UNDERTAKING.

### Report and Accounts for the Year 1914.

We have received from the Zürich gas undertaking a copy of the report and accounts of the Corporation Gas-Works for the year 1914. The following is a summary of its contents.

The report opens with observations on the effect of the outbreak of war on the working conditions of the gas-works. The mobilization of the whole of the Swiss Army which followed the outbreak of war had a great effect on the working. To compensate for the loss of the men called up, a change was made from eight-hour to twelve-hour shifts; and in the first few months of the war the charges were left in the vertical retorts for twelve hours instead of ten hours. Later, when other men had been trained to do the work, normal conditions of working were restored. After some delay, owing to the scarcity of workmen, the construction of the new ammonia works was completed. At the time war broke out the stocks of coal on the works were quite up to normal; but the supply from Germany ceased at once on mobilization. Official representations, however, secured permits for further export from Germany, and small consignments of Westphalian and English coal were obtained from stores on the Upper Rhine, and, later, deliveries from the Westphalian and Saar pits were obtained, though the quantities fell short of those contracted for. Recourse was had to descriptions of coal not commonly used on gas-works, and considerably increased prices had to be paid for these special supplies. The Coal Association of Swiss Gas-Works assisted greatly in securing deliveries of coal.

The gas consumption in August last year receded by 12·4 per cent. compared with August, 1913; and at the end of the year there was a decreased consumption of 8 08 per cent. The decrease was principally among private consumers. The reduction would have been greater but for the installation of large numbers of prepayment meters for 20 centime (2d.) pieces. On the outbreak of war the importance of the stock of coke—which was about normal—to the City was recognized; and in view of the great demands which at once ensued from private consumers, deliveries were restricted to half-a-ton apiece.

The export of ammonia and tar to other countries having ceased with the outbreak of war, concentrated liquor was worked-up to sulphate, and tar was consumed under the boilers on the gas-works and in other ways. The old ammonia works was provisionally restored for the working-up of liquor to sulphate. Later a very strong demand set in for the vertical-retort tar for use in Diesel engines, for which the normal supplies of crude oil or tar oils were unobtainable. The vertical-retort tar gave quite satisfactory results for the purpose. In view of the uncertainty of the coal supply, public lighting was restricted to the lamps which ordinarily are kept alight throughout the night, and in most of the lanterns with two burners only one burner was used. The conditions had a very adverse effect on the accounts of the undertaking for the year, the net profit being 170,000 francs (£6800) less than the estimate.

The new double centrifugal pump erected for keeping the works' drainage system clear of water when the River Limmat is in flood discharges at the rate of 440 gallons per second through a 36-inch main. After the well (which was sunk in 1913) had been in use for six months, the water from it was again examined, and found to be good drinking water, though hard.

The mains have been extended to supply certains suburbs of Zürich. For the whole year the gas consumption showed an increase of 0·11 per cent. over that for the preceeding year. The total production of gas was 37,784,600 cubic metres (1,333,353,150 cubic feet), the average make per ton of coal carbonized being 12,501 cubic feet. The make of gas per ton of coal in the inclined retorts was 11,124 cubic feet, in the settings of ten vertical retorts 12,939 cubic feet, and in the settings of eighteen vertical retorts 13,040 cubic feet. The coal carbonized was almost wholly German, and the average cost of coal per 1000 cubic feet of gas made was 2s. 1d., as compared with 2s. in 1913. The private gas consumption was 86·86 per cent. of the total, and the gas unaccounted for was 3·55 per cent. The balance was consumed in public lighting, public buildings, and on the works. The coke consumed as fuel under the retorts amounted to 14 per cent. by weight of the coal carbonized in the inclined retorts and in the settings of eighteen vertical retorts, and to 15 per cent. in the settings of ten vertical retorts. Steam was introduced into the vertical retorts.

The yields of bye-products, in percentages by weight of the coal carbonized, averaged as follows: Coke, 70; real ammonia, in gas liquor, 0·2328; tar, 6·35; retort carbon, 0·023; Prussian blue in cyanide sludge, 0·054. The yield of tar is slightly higher; but the yield of other bye-products is the same as, or slightly lower than, in 1913. Anthracene oil was used for extracting naphthalene from the gas at the rate of 2 oz. per 1000 cubic feet.

The examination was continued of the efficiency of various gas fires and cookers. The fires with columns of incandescent fuel (as used in England) were found to give a better heating of the lower parts of the room, and thus avoided the evil of cold feet. Such fires, having actually a lower total heating efficiency, afford (the report states) a more rational heating than other types of fire with a higher efficiency. There are at present gas-cookers on the market having from 60 to 70 per cent. efficiency, and with certain adaptations a still higher efficiency is obtainable. As regards utilization of the total available heat from the gas or current, the gas cooker is thus scarcely inferior to the electric cooker.

Investigations were carried out in the course of the year on the reference from the International Committee on Illumination as to the effect of atmospheric pressure on the light of the hefner lamp. These investigations were made at four different mountain stations.

The accounts show a total net profit on the working for the twelve months ending Nov. 30 of 1,513,621·93 frs. (about £60,544); which is a decrease of about £7415 on the net profit for the preceding twelve months.

The management of the gas undertaking, rendered vacant by the death of Herr A. Weiss on Dec. 16, 1913, has been placed in the hands of Herr Fritz Escher, of Zürich, who had been engaged as Works Manager at the Strassburg Gas-Works. His appointment dates from the 1st of April, 1914.

## MUNICIPAL UNDERTAKINGS AND INCOME-TAX.

Alderman Copeland, Lord Mayor-Elect of Manchester, and Chairman of the Finance Committee of the Corporation, referred at last Wednesday's meeting of the City Council to what is known as the Leeds income-tax re-adjustment case. He said it had been the contention of the Committee for some twenty years that the income-tax should be based on the same principle as was applicable to a private firm. The basis of income-tax lay in the fact that, in a private business, if a man had one or two departments, or branches, and one branch made a profit and the other a loss, he was enabled to set the loss against the profits, and make a return on this basis for income-tax. They had all along urged that the Corporation should be treated in the same way; and now, after many years, this contention had been upheld, and they had effected a saving of £105,000 by the Leeds decision.

In answer to a question by Sir Alexander Porter, as to whether the decision affected the future, the Lord Mayor (Alderman M'Cabe, J.P.) said it settled the principle.

## THE DYESTUFFS SITUATION IN AMERICA.

In previous issues of the "JOURNAL," reference has been made to reports on the dyestuffs situation in the United States which have been submitted to the Department of Commerce by Mr. Thomas H. Norton, their Commercial Agent. In some noticed in a recent number of the "Gas Age" (New York), he reviews the general situation, and gives the following as the controlling factors.

The stock of dyes of German origin in American warehouses and mills is rapidly approaching exhaustion. Permission for the free passage of two cargoes of German dyes for American consumption—sufficient for two to three months—was granted by the British Government on April 14; but thus far permit for export has not been granted by the German Government. An ample stock of coal-tar dyes, ready for export to the United States, is held by the German manufacturing firms. It awaits the opportunity and assurance of safe transport. The American Government, through the Department of State, is exerting every possible effort to bring about such an understanding with the opposing belligerent powers in Europe, so that free passage may be granted to dyestuffs of German origin destined for consumption by American industries. This effort is earnestly seconded by the agents of the Textile Alliance, formed by the union of five great American textile associations.

Expert opinion regards as highly probable a complete suspension of all imports of German dyes for several months, possibly for the remainder of the current year, if not longer. The importation of Swiss dyes—forming normally about 9 per cent. of the total imports of artificial colours, and exceeding $9,000,000 in annual value—continues in diminished volume. The value during the March quarter of the present year was $191,000.

The existing American coal-tar chemical industry is making every effort to increase its output, and is rapidly overcoming the handicap resulting from its dependence in the past on German intermediates. This output will steadily increase with each passing week. An ample supply of American coal-tar crudes is assured for the prospective needs of dyestuff manufacturers. The American manufacture of aniline and other coal-tar intermediates from American crudes has been started upon a generous scale by all existing dyestuff works, and by five new plants specially devoted to this field. Several other works are in process of erection or in contemplation.

The foundations for a genuine American coal-tar chemical industry are apparently being laid. This industry can supply only a small share of the American demand for the current year, but is susceptible of steady and relatively rapid expansion. No provision is yet made for the American manufacture of alizarin or of synthetic indigo.

American consumers of artificial dyestuffs are promptly taking steps to use natural dyestuffs and mineral colours, during the time that the output of American dyes is necessarily limited. American manufacturers of natural dyestuffs in the form of pastes, extracts, &c., are making adequate preparations to supply the expected demand. They are providing ample instruction in the modern approved methods of using vegetable dyes.

There is a general recognition of the fact that the prospective scarcity of artificial dyestuffs is due to circumstances entirely beyond the control of the American Government and of the American colour industry, and that both are making every effort to lessen the inevitable hardships attendant upon the unprecedented conditions. Consumers of dyestuffs are resolutely adjusting manufacturing processes, so that they may be prepared in time to revert to the use of natural dyestuffs or mineral colours with a minimum of friction, should the necessity arise. Consumers of dyed materials are good-humouredly accommodating themselves to a prospective limitation in the gamut of colours. All sense of hardship disappears before the huge pall of misery and suffering hanging over the countries now engaged in the struggle that

has caused this temporary famine in a class of materials almost indispensable to many American industries.

Mr. Norton next deals with the question of the probability of establishing a self-contained American coal-tar industry; and he offers the following observations thereon: The spontaneous effort on the part of American capital and enterprise to meet the exigencies of the present emergency reveals the existence of dormant possibilities of far-reaching importance. Adequate steps have been taken to assure an abundant supply of all the coal-tar crudes needed by a well-rounded American coal-tar industry as fast as the demand develops. A strong effort is being made to establish upon a firm basis the manufacture of a wide range of American coal-tar intermediates. The manufacture of a limited number of staple coal-tar dyes is being pushed with remarkable energy; and the number of these dyes promises to increase steadily. Evidently much has been done during the last few months to lay the foundations of a genuine national industry capable ultimately of meeting the great mass of American demands for artificial dyestuffs.

Unquestionably much of the capital invested during the last few months has, Mr. Norton points out, been in the nature of a speculation. At current rates for aniline and for finished dyestuffs, there was a fair chance of quickly covering the cost of a new plant, of making a good profit, and of being in a satisfactory shape, at the return of normal conditions, to embark in competitive manufacture under favouring circumstances. Numerous interviews with those who have participated in these preliminary steps in the evolution of a national industry have brought to light a marked confidence on their part in the final success of the undertaking provided the capital invested is exposed to no more danger than that involved in fair and open competition with foreign manufacturers of dyestuffs.

Mr. Norton concludes by reviewing the situation in Great Britain.

## PROPOSED GERMAN NITRATE MONOPOLY.

**[From the "Chemical Trade Journal," Sept. 4.]**

The Budget Commission of the German Reichstag has now issued a report dealing with the projected establishment of a State monopoly in nitrogenous fertilizers. It is stated that since the outbreak of war the German production of fertilizers from atmospheric nitrogen has increased enormously—particularly of sulphate of ammonia by the process under exploitation by the Badische Anilin und Soda Fabrik, and of calcium cyanamide; and it is asserted that the manufacturing cost is sufficiently low to enable these fertilizers to be sold at prices below those which have prevailed during the past ten years. It is feared, however, that after the war German makers will have to meet very keen foreign competition; and it is to enable this to be overcome that the scheme is put forward. It is pointed out that Chili has an export duty on nitrate of soda; and the reduction or removal of this duty would make a very important difference to the competitive ability of Chilian nitrate, as against the synthetic products. It is also feared that after the war foreign producers may organize. The German Financial Secretary of State has placed information before the Commission which is said to show that the English and French Governments have negotiated with the Chilian Government with a view to obtaining control of the nitrate industry; and although it has hitherto been impossible to arrive at an agreement on the matter, it is considered by no means impossible that this will be done later. Reference is also made to the North-Western Cyanamide Company. It is stated that attempts were made before the war to form an International Trust which would include this concern, the English interests in Chili, and the American group which controls large water-power plant in the United States and Canada. A price-cutting war with this group after the war might prove fatal to German producers; and particularly to producers of bye-product sulphate of ammonia. Those who have objected on the ground that the scheme would result in an advance in prices, and that processes incapable of competing effectively would be protected, are told that maximum prices would be fixed which would not be higher than those prevailing before the war.

## DISPUTE AS TO A WATER SUPPLY IN BULK.

### A North of England Arbitration.

Earlier in the year, as was briefly announced in the "JOURNAL" at the time, an arbitration took place with reference to a dispute between the Morpeth Corporation and the Tynemouth Corporation, which had arisen out of an agreement for a supply of water in bulk by the latter authority to the former. After a hearing which extended over two days, the Arbitrator gave his award in the form of a special case for the consideration of the Court; and the result was recently announced as being in favour of Morpeth. As the matter is now determined, some fuller notice may be taken of the different points in dispute, and of the arguments that were adduced on one side and the other.

The arbitration proceedings were held at the Surveyors' Institution, Great George Street, S.W., before Mr. A. J. RAM, K.C., as Arbitrator. The Counsel appearing were Mr. HOLMAN GREGORY, K.C., and Mr. SCHOLEFIELD, for the Morpeth Corporation; and the Hon. J. D. FITZGERALD, K.C., and Mr. C. F. LOWENTHAL, for the Tynemouth Corporation.

Mr. HOLMAN GREGORY, in opening the case, pointed out that the dispute had arisen upon the terms of an agreement which was entered into between the two Corporations on July 25, 1905. By this, the Tynemouth Corporation agreed for a supply of water in bulk to the Morpeth Corporation by, and from, a connection to be made with the gravitation main of the Tynemouth Corporation running from their Font reservoir to Tynemouth at a spot on Morpeth Common; and the dispute was in respect of the manner in which the water was to be supplied. Morpeth, he said, was a town with a population of between 8000 and 9000, some twenty miles north-west of Tynemouth. For some years, Morpeth had had its own water undertaking; but it was not now considered by the Corporation to be sufficient to provide, with a margin of safety, for the requirements of the people. As to the Tynemouth undertaking, in 1897 the Corporation purchased the North Shields Water Company; and in the following year they obtained power to take water from the River Font, some thirty miles away from Tynemouth. Power was also secured for the construction of a very large reservoir, with a top-water level 611 feet above Ordnance datum [the ground levels in Morpeth ranging from 84 to 196 feet above Ordnance datum], and the laying of gravitation mains. Further, power was taken in the same Act to supply water in bulk to any councils within ten miles of the main, along its course. As the result of negotiation, Morpeth and many other councils within the area entered into agreements to take an optional supply of water from Tynemouth. It was the consequent written agreement which the Arbitrator had to construe. This set out the price and conditions of supply; and it was clause 4 over which the dispute arose: "That the Morpeth Corporation shall take such supply of water aforesaid from the gravitation main of the Tynemouth Corporation at such place or places in the land called Morpeth Common, belonging to the Morpeth Corporation, as shall be agreed upon. The Tynemouth Corporation shall make the connection; and the cost thereof shall be borne by the Morpeth Corporation." So the Morpeth Corporation were to come and take the supply; and they were to take it from the gravitation main. At a later stage, the Morpeth Corporation requested a supply of water, and suggested that they should tap the gravitation main at that spot, fit up a meter and the necessary valves, and connect the pipe with an 8 inch main of their own, which ran from the reservoir connected with one of their three sources of supply into Morpeth. This was a perfectly simple thing to do; in fact, he believed it was the system which had been adopted in every case in which water had been taken from the gravitation main for supply to councils within the terms of the Act of 1898. The Tynemouth Corporation, however, refused to give this connection, and said that Morpeth must build a receiving well or tank; that they would deliver water from their main into this tank; and that Morpeth must connect the tank with their own main, and so take their supply of water. In other words, what they wanted to do was to rob Morpeth of one of the chief merits of this water—namely, the pressure which was to be obtained by reason of its coming down from the reservoir which was situated some 600 feet above Ordnance datum. This would greatly minimize the value of the water to them, because it meant that the supply would, unless the Corporation provided a pumping-station, or something of the kind, be useful only in the very lowest parts of Morpeth—the spot for the receiving tank being about 200 feet. He suggested reading some letters written prior to the drawing-up of the agreement.

Mr. FITZGERALD remarked that he did not see how letters written prior to the agreement could be evidence for the purpose of construing the agreement. He thought it was settled law that one could not go into any negotiations or correspondence for the purpose of interpreting an agreement. The reason he was rather anxious that the case should be conducted on strict lines was that it was obvious, whatever view the Arbitrator might take, a question of law would arise as to what the proper construction of the agreement was; and it was therefore his intention to ask the Arbitrator to state his award in the form of a special case.

Mr. HOLMAN GREGORY said he could not, of course, object to this; but it was rather a pity to add to the expense and trouble of the matter, when they were before an Arbitrator. He thought the Arbitrator was not bound to state a special case.

The ARBITRATOR: If I did not state one, you might make me.

Mr. HOLMAN GREGORY (continuing) stated that in the course of correspondence between the respective Surveyors it was agreed that there should be a 3-inch connecting main from the 18-inch gravitation main to the Morpeth 8-inch main; but later the suggestion of the concrete tank was made, which would have had the effect of breaking the natural pressure from the gravitation main. The original agreement was to supply water in bulk from the gravitation main, which involved it being under pressure. The parties could not decide the matter themselves, and so these proceedings had to be taken.

Mr. FITZGERALD, after some argument as to the admissibility of certain matters, said he agreed, and it had been understood all along, that the Arbitrator had merely to decide the method by which water from the Fontburn reservoir should be transported from the gravitation main into the main of the Morpeth Corporation.

Mr. *James Jardin*, examined by Mr. SCHOLEFIELD, said he was Town Clerk of Morpeth, and he proceeded to deal with correspondence which had taken place between the parties.

Mr. *John Davison*, Borough Surveyor of Morpeth, in answer to Mr. HOLMAN GREGORY, stated that there was no engineering difficulty in the way of making such a connection as his Corporation desired; and if such a connection were made, the water would reach them at considerable pressure, and be available for the whole of Morpeth. Such an arrangement would be likely to be less detrimental to Tynemouth than if the water went into the tank. If supplied as Tynemouth desired, the water would not be available for more than one-half of Morpeth; and there were other objections.

Cross-examined by Mr. FITZGERALD: They were entitled under the agreement, after notice, to take 20 gallons per head per day for the population; but they were not bound to say what quantity they were going to take, or for how long. Even if they gave notice to do so, they were not bound to take any water at all. What they asked for was a connection between the Tynemouth gravitation main and the Morpeth gravitation main. His Corporation were supplying a very few houses outside the town.

Mr. *E. Brough Taylor*, examined by Mr. HOLMAN GREGORY, said there was nothing in the agreement which could in any way suggest a tank. The words in clause 4 of the agreement conveyed the meaning to him that the water would be taken direct from the gravitation main under the pressure that was inherent in the water in the main. He had never in a single instance heard of what the Tynemouth Corporation proposed being done; and he saw no reason for it in the present case. It could be no advantage to Tynemouth, while it was a great disadvantage to Morpeth. There was no engineering difficulty in making a direct connection.

Cross-examined by Mr. FITZGERALD, witness said he knew nothing about the Dearne Valley case, in which Counsel said the part about pressure being broken in the case of a bulk supply was before the Courts. He simply spoke of his own practice. If a connection was made by means of a 3-inch main as had been suggested, it would take 24 hours to get 160,000 gallons of water through. Under the construction which Morpeth put upon the agreement, they might keep the valve open for the busy hours of the day, and shut it off afterwards. The supply might be anything up to 140,000 gallons a day. If Morpeth took the whole of the water they required in twelve hours, it would, of course, interfere with the due flow of water in the gravitation main. There were filter-beds just below the Fontburn reservoir; and to take the water from the gravitation main irregularly would alter the rate of filtration, which might be objectionable, though things would be balanced by the subsequent clear-water tank. With the pipe now suggested, it would be impossible to take off the whole 140,000 or 150,000 gallons in twelve hours. A 2-inch main would not give the supply at all. He knew the population was increasing, and that the Corporation were entitled to a supply of 20 gallons per head.

Re-examined: If the system proposed by Tynemouth should be adopted, only part of the town could use the water, so that the 20 gallons per head could never be required.

Mr. *A. S. Dinning*, questioned by Mr. SCHOLEFIELD, said that as a civil engineer he had had considerable experience of water-works, particularly in Northumberland. In connection with schemes of this kind there, direct connections were customary; and he know of no other. He concurred in the evidence already given, that the Tynemouth proposal would be absolutely useless for the higher parts of Morpeth. In case of fire, it would serve only for the very lowest part of the town.

Mr. *Charles Hawkesley*, examined by Mr. HOLMAN GREGORY, stated that there was no engineering difficulty involved in a direct connection. To call for such a connection was not only not unreasonable, but it was contemplated by the agreement. If one considered the quantity of water brought down by the Tynemouth 18 inch main, and the small quantity Morpeth were entitled to take, it was obvious that a direct connection could not be to the detriment of Tynemouth.

Mr. FITZGERALD (in cross-examination): If you, as an experienced engineer, wanted water delivered under pressure, you would say so, would you not, so that there should be no question about it?

*Witness:* If I had been wanting not to be bound to deliver it under pressure, I should have said so.

Is it a convenient or proper arrangement that no quantity of water is to be specified which is to be taken, and no period during which it is to be taken?—No; that is not desirable. But then we must look at the circumstances. Here were the Tynemouth Corporation trying to outbid the Newcastle and Gateshead Water Company; and therefore they no doubt did not want to put in the needful restrictions.

This method of dealing with water, by which you may take your full supply one day, then no water for two or three days, and then take your full supply on another day, is not either a convenient or a reasonable method of dealing with the water supply?—I should not consider it reasonable; but the parties, when entering into the agreement, apparently did.

Mr. HOLMAN GREGORY intimated that this was his case; and evidence for Tynemouth was then called.

Mr. *E. Sandeman*, examined by Mr. LOWENTHAL, said he designed and carried out the Derwent Valley water scheme. The gravitation main of the Tynemouth Corporation referred to in the present case ran for a distance of 24 miles from the clear-water tank below the filters at Fontburn, to the Moorhouse service reservoir, from which it was distributed over the town. The gravitation main was not designed as a distributing main, but to discharge an even and continuous quantity of water per day into the service reservoir. But it had been so used to some extent since. There was a distinction in water-works between pipes that were intended to carry a continuous flow, and those which were to deal with an irregular flow. In fact, one might say waterworks should be divided into two parts, for continuous and irregular flows. What Morpeth suggested would enable them, in the first place, to take an irregular supply; in the second, to take an undetermined quantity, which might vary from day to day; and, thirdly, it would give them a large pressure over and above that obtainable from the receiving tank proposed by Tynemouth. The tank suggested by Tynemouth was with a view to regularize the supply during the whole 24 hours; and if this were adopted, the functions of the gravitation main would not be interfered with. Tynemouth had no objection, as he understood it, to giving the water; but they did not wish their gravitation main to be really ruined by being converted from an ordinary main delivering water regularly into a distributing main.

The ARBITRATOR: Is it not so already?

*Witness:* It is to some extent; but the more it is increased, the worse it gets.

Mr. HOLMAN GREGORY (in cross-examination): How does the proposed tank obviate the trouble of irregular supply? Suppose we only wanted water for an hour, you would only supply it through the tank for an hour. Would not that be an irregular supply?

*Witness:* It would, if it were considered a reasonable thing.

It is a false point to say that supplying through the tank is going to make any difference, or make the supply any more regular, than taking it from the gravitation main?—I agree unless we come to some arrangement as to quantity.

I put it to you that there are already six or seven direct connections, at different places, with this gravitation main?—Yes; and the total population served by them is about 50,000 people.

Re-examined by Mr. FITZGERALD: If the proposed direct connection of Morpeth with the gravitation main was persisted in, the duplication of this main would be rendered necessary much sooner than would otherwise be the case. The cost of the existing gravitation main was about £100,000.

Mr. *J. H. Smillie*, the Borough Surveyor of Tynemouth, having been questioned as to the correspondence which had passed between the parties, and as to what transpired in connection with certain Parliamentary Bills, the hearing was adjourned.

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An account of the second day's proceedings is held over.

## ANTWERP WATER SUPPLY DURING THE SIEGE.

At the last meeting in London of the Antwerp Water-Works Company [see "JOURNAL" for April 6, p. 17] some particulars were given as to the damage caused by the Germans to the water-works of the city and the efforts made to maintain the supply of water to the inhabitants. "Engineering" for the 3rd inst. refers to the difficult task to which the management of the undertaking has been brought face to face and the way their difficulties were, to an extent, overcome. Our contemporary remarks: As the water-works lay in the district through which the enemy advanced, only the water from the Shelde could be relied upon for distribution; but, owing to the influence of the tide, the Shelde water is both salt and muddy. It was therefore necessary to give the water time to settle, before it entered the pipe system. For this purpose, a large dry dock, capable of holding some 30,000 cubic metres, was pumped empty two hours after the commencement of each tide—experience having shown that the Shelde water at this time contains the smallest percentage of salt. After the necessary clearing process, which was accelerated by adding a solution of alum, the water was pumped successively into three other docks of an aggregate capacity of 45,000 cubic metres. In the first dock the water was sterilized by the addition of chloride of lime; and from the last dock it was pumped into the pipe system of the town. The pumping from the large dock into the three smaller docks, and thence into the town pipe system, was effected by several small tug-boats, which otherwise served for fire-extinguishing purposes in the harbour. This emergency water-supply installation was erected in August' 1914, and it was brought into use on Sept. 27; the water-works on the Nethe having been compelled to cease operations owing to the advance of the enemy. It then transpired that the pipe from the docks to the pipe system was not large enough, so that the water could not be sent to the higher storeys of the houses. On account of the bombardment, the installation of a new and large pipe-line from the docks could not be completed; and it was then decided to send the water to the reservoir station at Leuthaagen, and pump it thence into the pipe system of the town by means of the powerful pumping-plant of that station. The water obtained in this manner, naturally, was not fit for drinking; and the people, by poster, &c., had to be warned against drinking it unboiled. After the fall of Antwerp, the proper water-works, which had suffered a good deal, were promptly repaired, and on Oct. 25 the temporary supply from the docks was discontinued.

## NOTES FROM SCOTLAND.

### From Our Own Correspondents.

*Saturday.*

The lighting of Glasgow streets is to be reduced by one-half after midnight—the purpose of the curtailed illumination being to restrict municipal expense and to make the city less conspicuous from above. The electric lights on one side of each street are to be extinguished at 12 o'clock where the new system is adopted; and the authorities suggest also that motorists can aid the purpose of the modified lighting by disposing of powerful headlights.

A special meeting of the Conveners of the various Committees of the Aberdeen Town Council was held last Monday to consider the situation of contractors to the Council who have been adversely affected by the war. The meeting resolved to make no concessions except in the case of the contractor who is responsible for the transport of gas coal to the city by sea. It was recommended that he should be allowed 8¼d. per ton, which represents a total concession of £1079.

The subject of coal contracts for the gas-works was discussed at last Thursday's meeting of the Dundee Town Council, on Mr. Spence moving disapproval of a minute of the Gas Committee instructing the Town Clerk to take whatever action he thought necessary to compel certain contractors to implement their coal contracts. It was pointed out at the Committee meeting, Mr. Spence said, that during four months of the contract no coal had been taken, though tendered; and the Convener, in reply, urged that they had the whole twelve months to take delivery, and it was not necessary that they should take regular monthly quantities. To carry this argument to its logical conclusion, the Gas Department might have refused to take delivery for eleven months, and demanded the whole contract during the remaining one. He moved that the matter be remitted back to the Committee. It would be better to compromise and get half the outstanding balance than possibly be landed in the Courts over it. They had no contract with the Coal Company; their contract was with the local agents, who were quite willing to implement their contract, but could not get delivery of the coal. The Convener of the Gas Committee (Mr. R. M. Noble) moved approval of the minute, on the ground that a principle was involved. It was well known that the Coal Company would not sell direct, but only through their recognized agents. The Gas Department never refused coal. Lord Provost Don said a good deal depended on the question whether the Engineer (Mr. Yuill) at any time during the period declined to take delivery of the contract coal when tendered. So far as the legal position was concerned, the Town Clerk was the proper person to advise. The minute was approved.

On account of the enhanced cost of coal, the Gas Committee of the Aberdeen Town Council have fixed the price of gas for the ensuing year at 2s. 6d. per 1000 cubic feet, which is an increase of 3d.

The accounts in connection with the Aberdeen Gas Department for the twelve months ending July 31 were issued on Tuesday last from the office of Mr. John T. Sorley, the City Chamberlain. The revenue account of the Department shows that after charging £12,019, as the sinking fund for the redemption of mortgages and gas annuities, and carrying £300 to the fire insurance fund, there is a credit balance on the account for the year of £4022, which added to the sum at credit at the beginning of the year, makes £7626 to be carried forward to the credit of the next account. The net liabilities in connection with the undertaking at July 31 amounted to £95,252—being gas annuities held by the public, as valued in 1897 at £154,059. At the present market price, the value of these annuities is £93,780; while the amount of

borrowed money, accounts due to tradesmen, &c., is £46,739, being a total of £140,519. The total amount of the capital account is £492,556. The increase in the value of meters is £1383, and in the value of gas-stoves £1202. In the revenue account, which amounts to £149,504, as compared with £149,522 last year, under gas and meter rents, consumers by ordinary meters contributed £73,461, consumers by prepayment meters £24,801, gas-engines £8595, and public lighting £1755—a total of £108,612, compared with £107,197 for the previous year. Residual products realized £38,329. In the expenditure account the manufacture of gas cost £97,884 compared with £109,159 last year, the sum expended for coal being £76,244, as against £82,767 last year—a decrease of £6523. The distribution of gas cost £4754, and rents, feu-duties, and taxes, £9101, while National Insurance was responsible for an expenditure of £202. The total expenditure is £149,504, being a decrease of £17 only compared with the previous year. The balance carried forward from the revenue and expenditure account is £23,634, compared with £11,664. The gas made was 966,768,000 cubic feet, compared with 989,598,000 feet last year.

In the accounts of the Aberdeen Electricity Department for the twelve months to the end of July last the net revenue, after charging £17,755 for sinking fund to pay off mortgages, was £4635. The net liabilities were £221,601, being the amount of borrowed money, accounts due to tradesmen, &c., less the amount due for current supplied, value of stores in hand, &c., £240,601, and less the reserve fund invested £19,000. The capital account amounted to £463,758, compared with £454,453 the previous year. Under this heading there was transferred to sinking fund £138,093, and to the depreciation fund (exclusive of motors), £64,512. The revenue account shows that the sale of current realized £55,740, compared with £56,810, and the hire of motors £3327, against £2889. On the expenditure side of the accounts the generation of electricity cost £16,029, as compared with £17,711 last year. The distribution of the electricity cost £1227, against £875 last year; and rents, feu-duties, and taxes were £6146, against £6107 last year. The revenue and expenditure account amounted to £60,231, compared with £60,353 the previous year—a balance of £32,222 having been carried to the net revenue account. The quantity of electricity generated amounted to 12,475,920 units—this being a record, and exceeding the previous year's quantity by 781,925 units.

## CURRENT SALES OF GAS PRODUCTS.

### The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 6.

Pitch is firm at 26s. net per ton in bulk at makers' works; and it is reported that this price has been established for considerable quantities. Other products are quoted: Solvent naphtha, 2s. 1d. naked; creosote, 4¼d. in bulk; anthracene, 40-50 per cent., 2¼d. per unit, casks free—all at makers' works, net cash.

Twenty-five per cent. sulphate of ammonia remains at £14 8s. 9d. per ton, net cash, in buyers' bags, at makers' works.

### Tar Products in the Provinces.

*Sept.* 6.

There is no alteration in the markets for tar products. The market for pitch is still very quiet, and no transactions of importance are reported. Solvent and heavy naphthas are in fair demand, and prices are maintained. Creosote is quiet, and fair quantities have been offering during the past week at reasonable figures without finding buyers. Crude carbolic and benzol are, of course, commandeered, and the prices fixed.

The average values of gas-works products during the past week were: Gas-works coal tar, 21s. 3d. to 25s. 3d. Pitch, East Coast, 21s. 6d. to 22s. per ton; Norfolk, Suffolk, and Humber ports, 19s. to 20s.; West Coast, 20s. to 21s. Manchester; 21s. to 21s. 6d. Liverpool; 23s. Clyde. Benzol, 90 per cent., North, 10½d. to 11d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Crude naphtha, in bulk, North, 6d. to 6½d. Solvent naphtha, naked, North, 1s. 10d. to 1s. 11d. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 3d. to 3 1/16d. Heavy oils, in bulk, 3 3/16d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 5d. to 3s. 6d. Naphthalene, £8 to £16; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

### Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Sept.* 4.

The better feeling experienced in the market last week has become more accentuated this week, and higher prices have been paid at all points for both near and distant delivery. The demand from abroad has not been large, but available supplies have been readily absorbed by middlemen in this country. The nearest prompt values at the close are £14 11s. 3d. per ton f.o.b. Hull, £14 13s. 9d. f.o.b. Liverpool, and £14 16s. 3d. f.o.b. Leith. The views of manufacturers have restricted business in the forward position, but sales have been reported at £14 17s. 6d. for October-December, and at £15 per ton for January-June, at the principal ports.

### Nitrate of Soda.

No further change has taken place in the values of this article, and the market has continued steady at 13s. 9d. per cwt. for ordinary quality, and 14s. for refined, on spot.

### Sulphate of Ammonia.

From another source it is stated that the market for this article has been exceedingly quiet throughout the past week, and some sales are reported at lower prices. Outside London, makes are quoted at £13 17s. 6d.; Hull, £14 7s. 6d.; Liverpool, £14 10s.; Leith, £14 12s. 6d.; Middlesbrough, £14 7s. 6d.

## COAL TRADE REPORT.

### Northern Coal Trade.

The coal trade is quiet—the export branch being affected by the limitation of licences, and by some scarcity of steamers, so that the quantities shipped are barely up to the recent average. In the steam coal trade, this quietness is perhaps the most marked; and there is an effect on the prices. Best Northumbrian steams are quoted about 18s. 6d. to 19s. per ton f.o.b.; but it is believed that a little lower price has been taken when early shipment was possible. Second-class steams are from 16s. 6d. to 17s. per ton; and steam smalls are plentiful at 12s. 6d. to 14s. 6d. per ton. For lack of boats or licences, one or two collieries have had an occasional idle day. In the gas coal trade, the home demand is increasing, and thus the pits are more regular in their working. Best Durham gas coals are from 19s. to 20s. per ton f.o.b.; second-class are 16s. 6d. to 17s. per ton; and "Wear Specials" are from 21s. to 22s. per ton f.o.b. There is not much doing in the way of contracts for gas coals; but a sale over next year at 20s. per ton f.o.b. for best kinds is reported. The output of gas coal is fair under the circumstances, but it will have soon to meet a fuller demand. Freights are steady at 8s. to 8s. 3d., Tyne to Thames—tonnage being in small supply. Coke is active. Gas coke is steady, though with a slight increase in production; and good makes are quoted from 28s. to 29s. 6d. per ton f.o.b. in the Tyne.

## Leeds Gas Prices Further Increased.

Intimation was made last week of the intention of the Leeds Gas Committee to recommend the City Council to increase the price of gas for lighting, cooking, and heating purposes 3d. per 1000 cubic feet from Oct. 1, making the price 2s. 8d. for consumers in the city by ordinary meter taking less than 500,000 cubic feet per quarter. In moving a resolution to this effect at Wednesday's meeting of the Council, Alderman Penrose-Green (the Chairman of the Gas Committee) said, with lower prices for larger amounts, for prepayment consumers in the city, the price will be 2s. 11d. per 1000 cubic feet, or 3s. 2d. with a cooker. It might be asked why, when the price was raised 3d. in June last, the Committee did not ask for an advance of 6d. straight away. Their reason at the time was that they were not sure what the price of coal would be. Since then there had been a good deal of controversy; and the Government had fixed the maximum price at a figure which meant an increase of no less than £54,000 to the department in the cost of coal alone. The General Manager (Mr. W. B. Leech) justified the proposed advance in the price of gas on other grounds—the increased cost of material, the increased charge for labour on account of the war bonus, and the reduced price the Corporation would get for residuals. The revenue of the Gas Department for the years ending March 31, 1914 and 1915, showed a deficiency of £49,000; and if the present proposed advance was not sanctioned, the deficiency would be increased by £10,000. The motion was carried without discussion.

**Wisbech Lighting Company.**—Mr. J. Cockett, presiding at the annual meeting of the Company, referred to the fact that the profits had been seriously diminished through the restrictions which had been imposed under the Defence of the Realm Act. The Directors recommended that a reduced dividend of 3s. 9d. per certificate should be paid—this absorbing £937. The number of private consumers had been well maintained, the undertaking having been very little affected by electric lighting competition. The abnormal rise in the price of coal had made an increased charge for gas unavoidable; the advance having been fixed at 6d. per 1000 cubic feet from July 1. The discount allowed for prompt payment is reduced by 2d. per 1000 feet; and there will also be a discontinuance of the allowance of the usual 1d. in the 1s. for gas supplied through prepayment meters. The shareholders had been the first to feel the adverse effect of the present conditions, as they relinquished a portion of their dividend six months before the price of gas was raised.

**Gloucester Gas Company's Profit-Sharing Scheme.**—The seventh annual meeting in connection with the Gloucester Gas Company's profit-sharing and saving scheme was held last week at the works; Mr. J. H. Jones (the Chairman of the Committee) presiding. The report stated that the bonus for the year was £613 3s., calculated at the rate of 7 per cent. for the nine months ended March last, and 6 per cent. for the three months to June 30—the price of gas having been raised 3d. per 1000 cubic feet for the last term. The bonus had been divided among the members, who numbered 114. The Chairman, in the course of his comments on the report, mentioned that 17 members of the profit-sharing and saving scheme had joined the Colours. One had been killed, and another wounded. The report and statement of accounts were passed; and the Secretary was instructed to debit every member with a deduction of 5 per cent. from the bonus payable to him this year; the total of such deductions to be paid to the Treasurer of the local branch of the Red Cross Society.

**Newark Gas Company.**—Mr. T. Bradley, who presided at the recent annual meeting of the Newark Gas Company, referred to the difficulties under which the concern had laboured during the past year. Owing to the increased price of coal and materials generally, the Directors felt it incumbent to raise the price of gas as from Sept. 21 by 3d. per 1000 cubic feet; but even this would not cover the enhanced price of coal, which, in the year just entered upon, would cost £2500 more than in the preceding twelve months. He was glad to acknowledge the loyalty of the staff during the very trying period through which they had been passing. The adoption of the report, which was agreed to, was seconded by Mr. T. Blagg, who expressed the view that the increase in the price of coal to the extent of £2500, which had been foreshadowed by the Chairman, would be the minimum. In addition, tar was not so valuable; and there was likely to be a decreased consumption of gas, while wages and the cost of materials had gone up. The price of gas at Newark was raised in the June quarter from 2s. 6d. to 2s. 9d.; the further increase to take effect during the present month, bringing it to 3s.

## A German Gas Company's Report for 1914.

The "Company for Gas, Water, and Electricity Undertakings"—having its head office in Berlin, and operating eight gas-works in different parts of Germany, one in Luxemburg, and one in Holland, as well as four electricity and two water works—has issued its report for the year 1914, in which the following points are of general interest: While the war did not greatly affect the receipts, the working expenses were very much increased. At some of the works, the expenditure on coal was 60 per cent. higher than in the previous year; and the prices obtainable for bye-products did not rise in the same proportion. At Diedenhofen, in Lorraine, the coke-oven works which had recently been supplying gas to the Company shut-down in the middle of August last year; and it became necessary to bring the old gas-works into use again. Towards the end of December, however, the coke-oven works were again able to supply gas. The total output of gas in the year at all the works showed an increase of 5·89 per cent. over that for 1913; but the increased cost of working has compelled the Company to reduce its dividend for the year to 4 per cent.

## Weston-super-Mare Gas Company.

At the conclusion of the proceedings at the half-yearly meeting of the Company, a visit was paid by the stockholders to the new works, an account of which appeared in last week's "JOURNAL" [pp. 446-8]. The Chairman (Mr. J. E. Norman, J.P.) remarked that the original intention of the Directors had been to have a formal opening; but the war had put an end to functions of this kind. For the business proceedings, no half-yearly report and accounts were issued; the meeting being called for the specific purpose of declaring a dividend. A statement of the half-year's work was, however, made by the Chairman; and this was of a gratifying character. He reported an increase of 13,720,800 cubic feet, or 12·18 per cent., in the sales of gas. For the first three months of the year, from 9000 to 10,000 soldiers were billeted in the town; and the holiday season had led to a great influx of visitors. The increased revenue enabled them, after meeting all the usual charges, to pay the maximum dividends, including the last issue of £15,000, without encroaching on the reserve fund—in fact, a satisfactory balance was carried forward. He had had a summary prepared of the various towns where prices of gas had been advanced through the war—a total of 211 companies giving an average increase of about 6d. per 1000 cubic feet. Though this was not actually complete, as prices were still going up in various parts of the country every week, he was proud to say that theirs was one of eight companies in England who had up to the present been compelled to advance the price of gas 2d. only. The new works were operating very satisfactorily and smoothly; and the Directors trusted that the economies to be expected from them would counteract to a very considerable extent the increased prices they had to pay for raw materials and labour.

## Shrewsbury Gas Company.

It was stated in the report which was adopted at the annual meeting of the Company that the profit on the working for the year ended June 30 amounted to £6623. There had been an increase of 8½ million cubic feet in the consumption of gas. Owing to the greatly enhanced costs dating from the commencement of the war, the Directors found it necessary to increase the price of gas to 2s. 11d. per 1000 cubic feet, from the end of the September quarter. Since then continually increasing costs of coal, and all other materials and labour, had compelled the Board to further increase the price of gas to 3s. 4d., from the end of the June quarter. An interim dividend of 2½ per cent. was paid; and the Directors now recommended the payment of another 2½ per cent, making 5 per cent. for the year, less income-tax. The Chairman (Mr. T. F. Poole) pointed out that the year had been one of difficulty. There was no prospect of residuals doing much to meet the greatly increased cost of coal, though the Board had made a favourable contract for tar, and hoped for somewhat improved returns from coke. But in this exceptional time of stress and strain, they must all shoulder the burden which the terrible war had thrust upon them. The reserve fund was nearly all invested in Consols (which they were now endeavouring to convert into the new war loan); and for several years past considerable sums had had to be provided to meet the continual depreciation. But the present slump in price could not be met; and the fund must suffer accordingly. As to the accounts, the utterly changed conditions rendered a fair comparison with recent years impossible. The result of the year's working showed £3556 increased receipts, £4326 increased expenditure, and £770 less profit; and £560 would be taken from the small profit and loss balance to make up the dividend to 5 per cent., less tax. The bad debts had amounted to only 8¾d. per £100 collected. The co-partnership scheme established two years ago had worked satisfactorily so far; and the relations with the employees had been good, though there had necessarily been many changes, through men joining the army. Wherever possible, their places would be open for them if they were fortunate enough to return. Though general expenses were so heavy, the Directors had not allowed any false economy to interfere with their usual practice of keeping the works in a good condition of repair. He felt sure that, with the help and skill of Mr. W. Belton (the Secretary and Manager), and the assistance of the officers and staff, they would be able to carry things through to a successful issue.

**Fire at the West Bromwich Gas-Works.**—On Friday afternoon, a fire broke out at the West Bromwich Gas-Works; and the fire brigade on arrival found some wood work and coal ablaze. Through the speedy arrival of the brigade and the prompt and effective measures of the Gas Department employees, the fire was prevented from getting anything like a firm hold; and there being a plentiful supply of water, the flames were extinguished before serious damage was done. The cause of the outbreak was a tar-tank overflowing.

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## Alliance and Dublin Consumers' Gas Company.

The Directors of the Alliance and Dublin Consumers' Gas Company announce a dividend at the rate of 5½ per cent. per annum, £8119 being placed to special reserve fund; and £10,662 being carried forward. Six months ago the dividend was at the rate of 2½ per cent. per annum. This time last year no dividend at all was paid.

## Woking District Gas Company.

In their report for the half year ended June 30, which will be submitted at the meeting next Monday, the Directors state that the sales of gas show an increase of 1·44 per cent. over the corresponding period of 1914; while the receipts from residual products also exhibit an increase of £248. The coal contracts having been cancelled, owing to the war, the difficulty of obtaining supplies caused great anxiety. Purchases covering short periods were made: and ultimately a contract was entered into to provide for the estimated consumption till June 30, 1916, but at a very considerable increase in the rates paid, in addition to an increased cost of lighterage. In consequence of this increase in the cost of coal, as well as the enhanced cost of all material used by the Company, the Directors felt it necessary to raise the price of gas 6d. per 1000 cubic feet as from March 31. The revenue for the half year has been £10,732, and the expenses on revenue account £8615, leaving a net profit of £2116 to be carried to profit and loss account, to which must be added the balance brought forward from the last account—£6062. After charging £250 interest on debentures and loans, and £21 contribution to the local relief fund, there remains an available balance of £3907. The Directors recommend the payment of dividends on the preference stock at the rate of 5 per cent. per annum, and on the "A" ordinary and "B" ordinary stocks at the rate of 5½ per cent. per annum, which will absorb £1739, leaving a sum of £2168 to be carried forward. In order to meet the growing demands of the district, an extension either of the carbonizing or storage plant had become urgent. The Directors consequently entered into a contract for the erection of additional producing plant, which they were advised was the more economical of the two alternatives. This extension will necessitate the raising of further capital; and an extraordinary general meeting will be held to authorize the issue of redeemable or irredeemable preference or debenture stock.

**Read Holliday and Sons.**—A private company having this title has just been registered, with a nominal capital of £100 in £1 shares, to carry on the business of dyers, manufacturers of and dealers in dyes, colours, chemical substances, &c.

**Price of Gas at Littlehampton.**—Owing to the increased cost of coal and all other materials, the Directors of the Littlehampton Gas Company announce a further advance of 4d. per 1000 cubic feet in the price of gas, as from Oct. 1. It has also been decided to suspend the payment of the customary interim dividend this half year.

## Weymouth Consumers' Gas Company.

At the half-yearly meeting of the Company, the Chairman (Mr. J. G. Rowe) was able to congratulate the proprietors upon a considerable increase in the sale of gas. It was stated in the report that the demand for gas was never before so high during the first half of a year; the quantity sold being 76,031,100 cubic feet, which was an increase of 9·74 per cent. on the 69,277,700 cubic feet sold in the corresponding half of 1914. Coal, which was the factor that gave the Board so much anxiety during the half year, cost nearly 50 per cent. more than it did twelve months ago. Some of the additional amount spent was caused by the larger tonnage required to produce the increased quantity of gas sold; but the bulk of the addition was due to coal having to be bought outside the contract, owing to the difficulty of getting the contract coal conveyed, and to the abnormal rise in freight charges. About one-third of the additional cost of coal was fortunately met by the better returns from residual products. When recently the question of entering into contracts for coal for the current year was before the Board, it was found that coal could be bought only at such high prices as would render it necessary, in the interest of the stockholders, for the price of gas to be raised. The Directors therefore gave notice that from the end of June the price would be increased from 3s. to 3s. 6d. per 1000 cubic feet to consumers using ordinary meters, and that slot-meters would be adjusted to make the increase in price as nearly as possible the same. Owing to the continued fall in the value of all investments, the Directors had deemed it prudent to depreciate the amount at which the Company's investments stood in the books by £1013, which sum had been debited to the net revenue account. The balance at the credit of this account, after providing for interest on the debenture stock and depreciation of investments, was £6007, out of which the Directors recommended the payment of a dividend on the ordinary stock for the half year at the maximum rate of 5 per cent. per annum. Speaking of the efforts that had been necessary to get sufficient coal to keep the works going, the Chairman said the output at the collieries was reduced, railways were congested, and trucks for carrying coal were at a premium. Added to this, the firm of steamship owners who, before the war broke out, had contracted to supply the Company with steamers, refused to carry out the contract, contending that it was suspended by the outbreak of hostilities. The Directors did not, however, take the same view, and, after prolonged correspondence and negotiation, succeeded in obtaining compensation for breach of contract. For a time they were unable to obtain any steamers, even at the high prices that were ruling for freight; and they were almost at their wits' end to know how to obtain coal enough to keep up a supply of gas, which on more than one occasion they thought would have to be considerably curtailed. In this dilemma they had appealed to the Admiralty, who gave their help by allowing their collier transports to bring the Company three cargoes. The report was adopted; and the efforts of the Manager (Mr. T. F. Canning), the Secretary (Mr. E. Y. Wood), and the staff received cordial recognition.


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## Allegations Regarding the Belfast Electricity Works Management.

At the last monthly meeting of the Belfast Corporation, Alderman Tyrrell, in moving the adoption of the minutes of the Electricity Committee, said two rather serious misfortunes had occurred at the power station. One was an accident to the 750 K.W. turbo-alternator, parts of the machine being scattered through the building; and the other a fire, which, however, did not lead to any hitch in lighting or power supplies. Mr. Alexander moved for an inquiry into the origin of the fire, which, he said, was nearly being the most disastrous happening in the history of the city. A little stronger blast, and the entire electric station, with its costly machinery, would have been utterly ruined. The City Electrical Engineer (Mr. Bloxam) said it was all through spontaneous combustion. He (Mr. Alexander) suggested that it was all through incompetence and mismanagement. Mr. R. Johnston, intervening, said this matter should not be gone into to the prejudice of the Council, as the insurance claim had not been settled. Mr. Alexander retorted that Mr. Johnston's attitude appeared to be to deceive the insurance company. He would not be a party to deceiving anyone or concealing anything. Mr. Curley said the men at the electricity station had for months been in terror of their lives, because they knew the machinery was in such a bad state that there might be an accident at any time. The combustion and waste had been going on for several weeks. He had reason to believe that the insurance companies were of opinion that there had been gross negligence in this instance. The disaster to the alternator was due to a like cause. Alderman Tyrrell said, in view of the very serious statements made by Mr. Alexander, it was due to the Corporation that the whole facts should be investigated; and on the understanding that a full inquiry would be held, Mr. Alexander withdrew his amendment, and the minutes were passed.

**A Loose Gas-Tap.**—At a Stockport gas-poisoning inquest, the Coroner said he had tried the gas-tap concerned; and it was very loose. Probably deceased, in turning off the gas, had accidentally turned it on again. The victim was a soldier, who was found dead in bed at his lodgings, with the gas-tap turned full on. He was said to be a teetotaller, and of a jovial disposition.

**Wolverhampton Gas Company.**—Mr. B. O. Clark presiding at the meeting of the Wolverhampton Gas Company, said the report was, as usual, very good. A net profit of £15,161 for the half year ended June 30 was shown. Since the last meeting, the Directors had been compelled, owing to the greatly increased price of coal and other materials, to advance the price of gas 3d. per 1000 cubic feet. Dividends were declared at the rate of 3 per cent. upon the preference stock, 5½ per cent. upon the consolidated stock, and 3½ per cent. upon the new ordinary stock, less income tax. It was further decided that the Directors' fees be paid free of income-tax. Assent was given to the payment of £100 towards the funds of the Red Cross Society.

## Hastings and St. Leonards Gas Company.

The 123rd half-yearly meeting of the Company was held last Thursday, when the Directors reported that the accounts for the six months ended June 30 showed a profit balance of £10,363, which, under the exceptional circumstances prevailing, the Directors considered satisfactory. The business of the Company, as was expected, had been adversely affected. The cost of oil, labour, and stores had increased, the higher freightage charge continued, and enhanced prices had to be paid for fresh supplies of coal. As was foreshadowed at the last meeting, it was found absolutely necessary to increase the price of gas 4d. per 1000 cubic feet, which was done as from the April meter-readings. Forty-three of the Company's employees had left in connection with naval or military service. The depletion of trained and skilled workers, particularly in the manufacture department, had necessarily caused the management considerable trouble and anxiety. Circumstances arising from the war had called special attention to the advantages of gas for cooking, heating, and industrial purposes. The Directors recommended the payment of the following dividends (less income-tax), which were at the statutory rates, having regard to the sliding-scale and the increased price: 6 per cent. on the 5 per cent. converted stock; 4½ per cent. on the 3½ per cent. converted stock; and £5 14s. on the 5 per cent. additional stock. The Chairman (Dr. G. G. Gray, J.P.) said they had passed through a time of intense and ever-increasing anxiety; and it was therefore a great relief when the accounts showed that the half year had been so satisfactory. They had made and sold less gas, and therefore made and sold less residuals; and yet they had £75 more revenue. They used less coal; but the cost of this had been more than £2000 in excess of that in the corresponding half year. A necessary consequence of the enormous increase in the cost of coal, oil, and freight had been the rise in the price of gas. Later on he hoped to have the privilege of explaining how they, and more especially their Engineer and General Manager (Mr. C. F. Botley), had been able to materially assist the Government. The report was adopted; and the officers and staff were thanked for their services.

**Price of Gas at Plymouth.**—The gratifying announcement is made by the Directors of the Plymouth and Stonehouse Gas Company that the price of gas will not be advanced during the coming winter. This is contrary to the expectations both of the Company and the consumers; for at the annual meeting a few weeks ago the Chairman (Sir Joseph Bellamy) referred to an increase of price as almost inevitable, and it was generally thought an advance would be made after the close of the present quarter. The price now charged is 2s. per 1000 cubic feet; and in comparison with the cost of house coal, the gas consumers have abundant reason for satisfaction at the supply of gas at this rate. In announcing the Directors' decision, Mr. H. B. Heath (the Secretary) says it is hoped that the arrangements made for regular supplies of coal will be satisfactorily carried through; and thus obviate the necessity of adding to local burdens during the coming winter.


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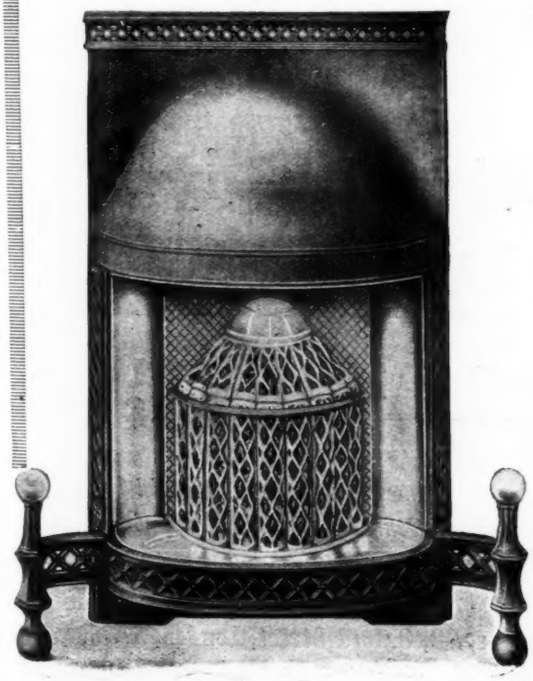

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**Cork Gas Consumers' Company.**—In moving the adoption of the report [*ante*, p. 469] at last week's meeting of the Company, Mr. W. B. Harrington pointed out that the rise in the price of coal and freights had necessitated an increase in the price of gas. One gratifying feature of the past six months was the substantial increase in the consumption of gas for cooking, heating, and industrial appliances. The development of gas for other than illuminating purposes had been progressive for a number of years; so that the quantity delivered in daylight, instead of being a comparatively small proportion of the whole, now represented nearly 50 per cent. of the total delivery at the same time last year. They had sold 324 cooking and heating stoves, which brought the number of these in use up to 6678, besides many thousands of smaller appliances. For industrial purposes, there had been additional installations of high-pressure gas. A dividend at the rate of 8 per cent. per annum was declared for the half year.

**Waterford Gas Company.**—Mr. J. H. Sugrue, presiding at the annual meeting of the City of Waterford Gas Company, said there had been a considerable increase in the quantity of gas sold during the year; this being mainly due to the popularity of gas for purposes other than lighting. At present they had about 2000 cooking-stoves fixed out among the consumers, in addition to a great number of fires, geysers, and other apparatus for gas consumption. The rise in the cost of coal had led to an increase of 5d. per 1000 cubic feet in the price of gas; but this would not, by a considerable amount, recoup the extra outlay incurred by the Company through the abnormal circumstances. For some years past, the Company had been paying what was termed the "statutory dividend," which bore a strict relation to the price charged for gas; and, unless circumstances changed much for the worse, they were likely to continue to do so. The report and accounts were adopted, and a dividend was declared making, with the interim dividend, a total of 7½ per cent. for the year.

**Redheugh (Newcastle) Gas-Works Ambulance Class.**—This class has recently been incorporated in the St. John Ambulance Brigade under the title of the Newcastle and Gateshead Gas Company's Division. It commenced with 26 members—a number which would have been greater if it had not been for the war, as 20 members who held first-aid certificates were serving with the army. Last Thursday evening the inaugural meeting of the division was held in the ambulance room at the Redheugh Gas-Works. Mr. J. F. Fowler, the Superintendent of the division, presided, and Mr. N. Reid, the Manager of the Redheugh Gas-Works, presented the certificates and prizes to the members who passed at the recent examinations. In the first class 22 members sat, and all passed; while in the second class 13 sat and 10 were successful. Mr. Reid also presented a pair of silver photo frames on behalf of the members to Dr. Dougall, of Dunston, in recognition of his services as lecturer. The members of the class also bought a walking stick for Mr. W. Hewitt, the class instructor, in recognition of his services. As Mr. Hewitt is with the St. John Ambulance Brigade serving with the colours, Mr. Reid handed the present over to the Secretary (Mr. W. D. Brown), to forward to Mr. Hewitt.

**South Metropolitan Company's War Fund.**—Dealing with the war fund of the South Metropolitan Gas Company, their "Co-Partnership Journal" says: At the end of our first year of existence, we have 22 widows and 40 orphans deprived of their breadwinners, besides several parents who were wholly or partially dependent on the earnings of some of our co-partners who have lost their lives in our country's cause. The year's payments to dependants amounted to £20.473. Our casualty list is a long one, and is ever increasing. The Committee have rendered assistance to the wives of our absent ones in many and diverse ways, and are always at their service whenever called upon for advice.

**Public Lighting of Dorking.**—At a conference between representatives of the Dorking Urban District Council and the Directors of the Gas Company, the latter agreed that it was reasonable the Council should ask for a rebate on the lighting contract for the period during which the lamps were not lit; but they also thought the Council should consider whether they could not meet the Company in connection with the extra price they were now paying for coal, which was very much above what the Company anticipated when they entered into the contract with the Council. The members of the Council have discussed the matter since, and eventually left it to the Roads Committee to get all the necessary information to enable a decision to be come to, and report later to the Council.

**Maidstone Street Lighting Regulations.**—A report of the Committee on Public Street Lighting containing the following proposals has been adopted by the Maidstone Town Council: (1) That 8 candle power lamps, coloured blue, and fitted with a narrow petticoat shade, be lighted at the junction of streets with the principal thoroughfare, and where else directed by the police. (2) In case of emergency, the Chief Constable be instructed to give definite orders to the Electrical Engineer (*a*) to extinguish the street-lamps, or (*b*) to shut-down entirely. (3) That no gas-lamps be lighted at present. (4) That the lamps proposed to be lighted in clause 1 be extinguished at 10 30, excepting those on the main road through the borough from London to the coast, which will remain lighted until dawn.

**Horley Gas Company.**—The profit and loss account of the Company for the half year ended June 30 showed an available balance of £1055, after providing for fixed charges; and the Directors recommended the payment of dividends at the rate of 5 per cent. per annum on the preference stock, 4 per cent. on the "A" capital stock, and £2 16s. per cent. on the "B" capital stock, all less income-tax. This would absorb £977, and leave a balance of £78 to be carried forward. In moving the adoption of the report and accounts at the meeting, the Chairman (Mr. Henry Webber, J.P.) said it was extremely satisfactory to note that, owing to the care and attention which had been given to the Company's business by the Secretary and Manager (Mr. R. Seymour Tobey) and the staff during the period under review, it was possible to present what he thought they must all agree with him in saying, considering the times they were passing through, was a most satisfactory balance-sheet.


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**The Davis Gas Stove Co., Ltd., Gas Exhibition Salons, 60, Oxford Street, London, W.**

**Gas Supply Failure at Stone.**—Last Saturday week, at about 10.30 p.m., Stone experienced the uncommon mishap of a failure of the gas supply; the interruption, which lasted about five minutes, being due to a hitch at the works. After gradually going lower, the lights died out; and it is reported that "much ready money was spent by slot-consumers who were under the impression that another copper in the meter was all that was needful."

**Bolton Gas Committee and Employees' War Allowances.**—At the last meeting of the General Purposes Committee of the Bolton Corporation, a resolution of the Gas Committee refusing allowance to the dependants of a workman who had enlisted without the permission of the Gas Engineer (Mr. W. Smith), referred back by the Town Council to the Gas Committee [*ante*, p. 309], was again discussed; and ultimately the Committee re-affirmed their resolution of Aug. 31, 1914, requiring employees to obtain permission to enlist. They instructed the various committees to give effect to this resolution.

**Deposit from City Air.**—For the purpose of carrying out an investigation regarding the air of the City, the Corporation last year placed a large rain-gauge on a roof in Golden Lane; the rain water from a known area of surface being collected monthly and analyzed. Similar observations are being made by the London County Council on the Thames Embankment. These are stated to be the first definite and tabulated records of impurity in the City air. Dr. Howarth, the Medical Officer, says that in December alone the amount of deposit registered as falling in the City amounted to 54½ tons. Of this mass of dirt, nearly 34 tons were soluble, and included sulphates of ammonia and chlorine, and 20½ tons were insoluble, and consisted of tar, carbon, and grit. No dense fog has as yet been tested. The examination is being continued.

**Price Increased at Tonbridge.**—The receipts side of the accounts of the Tonbridge Gas Company for the past half year, which were adopted at the meeting last week, showed increases in most of the items, the total income being £12,579, against £12,350 for the corresponding half of last year. On the other hand, the increased expenditure for coal came to £1296. Many of their best men had gone to the front; and the Secretary and Manager (Mr. J. Donaldson) had had a certain amount of trouble with regard to the labour question. But all was now satisfactory at the works. The total expenditure for the half year was £10,638, showing a profit of £1940, and £5455 available for dividends. The consumption of gas had been practically stationary. As to coal, they had had to pay an average of 9s. per ton more than last year, and over 12s. per ton more than two years ago. Owing to this, it had been necessary to raise the price 4d. per 1000 cubic feet, as from the 30th inst. The increase had been postponed as long as possible; and he would point out that the extra cost of coal was equal to an increase of 9d. per 1000 cubic feet. The Directors had, however, decided to utilize the undivided balances which had accumulated in order to meet such an emergency as the present. Last year they had a record consumption; and the fact that they had been able to maintain it was very satisfactory.

**Local Government Board and Economy.**—Mr. F. H. Tulloch held an inquiry last Wednesday, on behalf of the Local Government Board, into an application of the Skelmersdale Urban District Council to borrow £2000 for the provision of a new gasholder and condenser at their works. Mr. A. Dickinson (the Clerk to the Council) said that, owing to the condition of the works, the township during last winter had been thrown into darkness. The Inspector replied that the Council would have to take the risk of this, as they were living in abnormal times; and the object of his visit was to "squeeze the Council down to the last farthing." He would like to know what they could do without. The Manager (Mr. E. Huntington) stated that if the condensers were supplied he would perhaps be able to manage for twelve months, if the Council would not add to the number of consumers. The Inspector said he would make this recommendation.

**Largely Increased Consumption at Colchester.**—Brief allusion was made last week [p. 470] to the accounts for the past half year of the Colchester Gas Company. These showed that the amount required to pay the maximum dividends was fully earned during the past six months without any increase in the price of gas, which remains at 3s. per 1000 cubic feet to private consumers, and 2s. 6d. to the War Office. How busy a time the Engineer and Manager (Mr. W. W. Townsend) and the staff must have had will be understood from the fact that the sales of gas for the half year show an increase of 17·42 per cent.; while reckoned on the slot-meter consumption only, the gain was 34 per cent. This gain in total business was secured in spite of a decrease of 5·75 per cent. in public lighting. The cookers on hire last year numbered 1349; this year the figure is 1780. The large increase in the sale of gas is due to two causes: (1) The prosperity of Colchester, owing to the number of troops in the town and the making of munitions and clothing at the factories; and (2) the pushing of the sale of gas and the easy terms granted for the hire or purchase of apparatus.

**War Allowances to Gas Workers.**—At a meeting of the Special Committee of the Stockport Corporation Employees' War Service Fund, it was reported that a letter had been received from an employee of the gas-works stating that when his wife attended at the Gas Department to draw the Corporation allowance, she was told his wages were more in the Army than he had had at the gas-works, and that there was nothing for her. In view of the resolution of the Council regarding allowances to the dependants of those who enlisted, the writer thought an injustice was being done to his wife and family. It was reported to the Committee that the employee referred to was in the mechanical transport branch of the service, and in receipt of 42s. per week, in addition to his wife's separation allowance of 17s. 6d. per week. The Committee resolved that, inasmuch as he was in receipt of pay in excess of his wages when employed at the gas-works—viz., 30s. weekly—they did not consider him entitled to any allowance from the Corporation. It was further resolved that a return be obtained of all employees of the Corporation in receipt of army pay in excess of their ordinary wages, and of all holding commissions.

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**Darkest Germany: Shortage of Gas.**—In contradiction to a statement recently reproduced in our columns, the "Maasbode" (an Amsterdam paper), under Saturday's date, states that it learns from Oldenzaal that the question of illumination next winter is becoming a difficult one in Germany, in consequence of the lack of petroleum, gas-meters, and copper for conducting wire. It has been proposed to fix unit prices for gas. The price of petroleum in some places is about 65 pf. per litre. The Government has forbidden German communities to buy petroleum on their own account; and petroleum can only be secured through the Central Purchase Committee in Berlin. Communities mention the quantities wanted, whereupon the Committee calculate the quantity which they may have.

**Increased Price at Gloucester.**—The increased cost of coal and other materials compelled the Gloucester Gas Company to raise their price 3d. per 1000 cubic feet as from the end of the March quarter; and the Directors in their recently issued half-yearly report announce a further increase of 5d. as from the commencement of the current quarter—a total rise of 8d. This brings the price, however, to no more than 2s. 6d. per 1000 cubic feet, with a discount of 5 per cent. for prompt payment, or 2s. 4½d. net. There has during the past six months been a slight increase in the sale of gas; and the revenue from coke and sulphate of ammonia shows a marked improvement. The payment of the statutory dividend for the half year of 5 per cent. prr annum on the consolidated stock was recommended by the Board.

**Electrical Engineers Fined for Bright Light.**—At the Bridlington Police Court last Saturday week, the Acting Borough Electrical Engineer (Mr. Frederick Ffrench) was fined £3 for failing to obscure the light from the roof of the engine-house of the electricity works. Two of the witnesses in the case were special constables, who are also members of the Town Council, the East Riding County Council, and of the local Bench of Magistrates; and they testified that the light was dangerous to the works and to the community. At Grimsby, William Atkinson, foreman at the Corporation electricity works, was fined £5 for a breach of the Lighting Restriction Order. The Chief Constable said the lighting had been unsatisfactory ever since the Order had been in force.

**The Torpedoing of the "Fulgens."**—The current number of the Gas Light and Coke Company's "Co-Partners' Magazine" gives [along with a sketch of the occurrence from particulars supplied] some details of the torpedoing of the "Fulgens," a steamer belonging to the Company, on Aug. 1, off the Norfolk coast, about a mile from shore. The vessel, which was launched in 1912, carried 3750 tons of coal; and up to the time of her destruction, she had conveyed approximately 500,000 tons. As a matter of fact, since the beginning of the war she had made 49 successful trips to Beckton, bringing about 180,000 tons of coal. The ship was torpedoed without warning, and was rapidly submerged; but happily Captain Laird and all on board were saved, though one man was injured. It was at 5 p.m. on the Saturday that the "Fulgens" left Hartlepool; and at 9 o'clock the following morning the torpedo which destroyed her was fired.

**Northwich Gas Company.**—At the half-yearly meeting, presided over by Mr. C. T. Eachus, a statement of accounts for the six months ended June 30 was presented, which showed that there had been an increased profit of £562 over last year's figures. The gas-rental was reduced by 5 per cent., chiefly caused by the curtailed street lighting—while expenses connected with manufacture had decreased 16 per cent. The Chairman stated that it was a source of gratification to receive such an excellent report, having regard to the awkward times through which gas undertakings were passing; and he expressed pleasure at the large increase of gas made per ton of coal carbonized. Interim dividends were declared of 4 per cent. per annum on the preference shares and 6 per cent. per annum on the ordinary shares.

**Reduced Gas and Electrical Consumption at Bognor.**—The military restrictions placed on lighting at Bognor have, so the Chairman (Mr. Henry Lovett, J.P.) informed the shareholders at the half-yearly meeting of the Gas Company, resulted in candles being used in many houses in place of other illuminants, in order to avoid prosecutions. The consequence was that the sales of gas had fallen something like 4 million cubic feet. The report which was adopted stated that the accounts showed a balance of £2911 at the credit of the net revenue account. From this sum, the Directors recommended the declaration of a dividend for the half year at the rate of 3 per cent. per annum upon the whole of the stocks, less income-tax. This would amount to £1105, leaving a balance of £1806 to the credit of the profit and loss account. Owing to the continued increase in the prices of coal and oil, the Directors much regretted that a higher dividend had not been recommended; but having regard to the great decrease in the revenue derived from public lighting and the reduced consumption of both gas and electricity by other consumers, they considered it advisable to husband the resources of the Company. The Directors had been, reluctantly, compelled to advance the price of gas from March 31.

## APPLICATIONS FOR LETTERS PATENT.

12,188.—Lewis, G. P., "Cracking hydrocarbons." Aug. 24.

12,205.—Acetylene Illuminating Company, Ltd., and Stephenson, A., "Storing gases under pressure." Aug. 24.

12,211.—Atton, J. H., "Prepayment meter." Aug. 25.

12,213.—Simpson, W. M., "Bunsen burners." Aug. 25.

12,258.—Lander, G. D., and Smith, C., "Producing toluene." Aug. 25.

12,278.—Payne, C. R., and Linsley, E., "Vertical retorts." Aug. 26.

12,279.—Payne, C. R., and Linsley, E., "Regenerator bricks." Aug. 26.

12,296.—Smith, D. J., and Towl, C., "Gas-generators." Aug. 26.

12,359-60.—Johnston, J., and the Globe Pneumatic Engineering Company, Ltd., "Rotary exhauster." Aug. 27.


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require that the products of combustion shall be conveyed from the room in which workers are engaged.

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**Street Lighting at Amble.**—During a discussion on the question of public lighting by the members of the Amble Urban District Council, the Clerk (Mr. R. Archer) said he had written to the Board of Trade with reference to the position of the Amble Gas Company and the Council. The Company had for years supplied gas for street lighting purposes; and the Council had recently applied to them to supply by meter, which they refused to do, and would only supply gas for street lighting at a lump sum of £200 per year. The Council did not think they were justified in accepting this offer, and applied to the Broomhill Collieries for a supply of electricity for public lighting. The Board of Trade had replied that the Public Health Act, 1875, empowered the Council to undertake the distribution for the purposes of public lighting of electricity supplied to them by other parties. As the Gas Company were non-statutory, they were not subject to the provision of the Gas-Works Clauses Act, 1871; and the conditions for the supply of gas for public lighting were a matter of agreement. Instructions were given to the Surveyor to prepare estimates for the introduction of electricity.

**Lighting Question at Halesowen.**—The Halesowen District Council, at their meeting last Tuesday, again had under consideration the question of the lighting of the parish. The Cradley Heath Gas Company wrote stating that they were willing to increase their allowance in respect of the lamps which had not been lighted during the winter months, from £50 to £75, and asking the Council to agree to an advance of 5s. per lamp on the contract prices for the ensuing year. The Halesowen Gas Company also sent a letter intimating that they were willing to increase their allowance from £85 to £120, and asking the Council to give them an increased price on the contract for the present season. The Cradley Heath Gas Company stated that, if the lighting was to be restricted by one-third during the winter months, they would be prepared to allow £1 5s. per lamp in respect of all lamps which were not lighted; and the Halesowen Company asked the Council to pay £3 per lamp, and an extra 10s. per lamp for those lighted. The Council decided to rescind a previous resolution for the lamps throughout the district to be lighted in accordance with the contracts.

**A Deposit Objected to in War Times.**—An applicant at Highgate is reported as having objected, on the ground of "national stress," to the fact that a deposit was demanded of him before he could receive a supply of gas. The Magistrate suggested that the gas company might be afraid he would not pay for the gas consumed. The applicant replied that this might be; but "in these times they must take their chance with other creditors." The Magistrate, granting a summons, said he would have to prove that the company, under their powers, could not demand a deposit. The applicant thought the Courts Emergency Powers Act would help him in his contention that at this time of national stress the company had no right to make the demand.

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The Local Government Board have sanctioned the re-borrowing for a period of ten years of the sum of £6200 for the provision of a new holder at the Oldbury Gas-Works.

The firm of Messrs. Biggs, Wall, and Co., gas and general engineers, has been registered as a limited liability company, with a capital of £6000 in £1 shares, 3000 of them being preference shares.

Owing to the fusing of some electric wires, a large portion of the roof over the centre section of the East Greenwich premises of the Molassine Company was damaged. The fire brigade were soon on the spot in strong force; and within about half-an-hour the outbreak was got under.

It may safely be assumed that every reader of the current issue of the "Tonbridge Free Press" will have read through a half-page advertisement bearing the name of the local Gas Company, and relating to the supply of high explosives. The facts brought out are all-important at the present juncture; and the Company's consumers should heed the moral they point. After quoting the "Yorkshire Post's" suggestion that a very proper recommendation from the Parliamentary War Savings Committee would be that people should use gas in preference to other sources of heat and energy, the derivation of toluene is explained, and an appeal is made to "support our men in the trenches by using gas for all purposes."

# GAS COMPANIES IN THE STOCK EXCHANGE.

The quiescent character of Stock Exchange business was continued last week, reaching a point approaching inanition on Saturday. The decision of the Committee to keep the House open that day was by no means universally popular. However, quiet as the week was, it was not without some favourable factors. The firmness of Home Government issues and the improvement in War Loan and in Consols were agreeable points; and this was shared by several Colonial issues. Home Rails made some recovery under the influence of the settlement (if settlement it can be called) of the South Wales trouble. In the Miscellaneous group, munitions and other industrial undertakings were strong, especially shipping; the latter being aided by evidence of the failure of the German submarine excursions to achieve any adequate success. Americans, and Canadians with them, were much unsettled by the vagaries of the American exchange, which fell phenomenally on Tuesday to 4·47, rebounded on Thursday to 4·64, and touched 4·70 on Friday. The laying of this stormy factor is an urgent *desideratum*. Movements in other lines were not remarkable. Business in the Gas Market was on the same scale of moderation which has characterized the past few weeks. Almost the only noteworthy feature was that some of the issues which less frequently come into notice were last week the subject of bargains. The general tone was firm; and in some instances the disposition was in favour of higher prices to a moderate extent. In the Money Market, rates were consistently easy for short loans and discounts; but on Thursday, the Banks raised their rates of interest allowed on deposits to 3½ per cent.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 78⅜, ditto preference 72½, Primitiva preference 3½, 3 1/16, 3⅛, South Metropolitan 80½. On Tuesday, Gas Light ordinary 78⅜, 79⅛, ditto preference 73, San Paulo debenture 88, 88⅛, South Metropolitan 80. On Wednesday, Alliance and Dublin 59¼, 59⅜, Cape Town preference 4½, Continental Union 39, Gas Light ordinary 78⅞, 79½, ditto debenture 63⅜, Imperial Continental 57, ditto debenture 68½, 69, Primitiva 2 17/32, 2⅝, ditto preference 3 17/32, 3 19/32, Tottenham "B" 102¾, 103. On Thursday, Newcastle 85, Primitiva preference 3⅛, 3 17/32, South Metropolitan 80, 82. On Friday, Gas Light ordinary 78½, 79, 79⅛, 79⅜, ditto debenture 62. On Saturday, Gas Light ordinary 79, 79⅛, ditto debenture 62, 62¾, 63.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

## LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING SEPT. 4.

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. July 30. | Yield on Highest Closing Price. | Lowest and Highest Prices of Bargains. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | £ s. d. | |
| 1,551,868 | Stk. | April 8 | 9½ | Alliance & Dublin Ord. | 59—64 | 3 18 2 | 59¼—59¾ |
| 374,000 | ,, | July 10 | 4 | Do. 4 p.c. Deb. | 76—79 | 5 1 3 | .. |
| 380,000 | 5 | April 29 | 7½ | Bombay, Ltd. | 5⅞—6⅜ | 5 17 8 | .. |
| 50,030 | 10 | Feb. 26 | 16 | Bourne-mouth Gas and Water { 10 p.c. | 29—30 | 5 6 8 | .. |
| 273,480 | 10 | ,, | 7 | { B 7 p.c. | 15—15½ | 4 10 4 | .. |
| 195,000 | 10 | ,, | 6 | { Pref. 6 p.c. | 13¼—14 | 4 5 9 | .. |
| — | — | — | — | { Deb. | .. — | — | .. |
| 880,000 | Stk. | Feb. 26 | 14 | Brentford Consolidated | 261—266 | 5 5 8 | .. |
| 880,000 | ,, | ,, | 11 | Do. New | 204—209 | 5 5 8 | .. |
| 50,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 109—111 | 4 10 1 | .. |
| 206,250 | ,, | June 11 | 4 | Do. 4 p.c. Deb. | 91—93 | 4 6 0 | .. |
| 217,380 | Stk. | Feb. 26 | 11 | Brighton & Hove Orig. | 208—213 | 5 3 4 | .. |
| 244,200 | ,, | ,, | 8 | Do. A Ord. Stk. | 154—159 | 5 0 8 | .. |
| 630,000 | 20 | Mar. 26 | 12½ | British | 44—45 | 5 11 1 | .. |
| 120,000 | Stk. | June 26 | 4 | Do. 4 p.c. Deb. Stk. | 88—90 | 4 8 11 | .. |
| 245,771 | Stk. | June 26 | 4 | Buenos Ayres 4 p.c. Deb. | 85—87 | 4 12 0 | .. |
| 100,000 | 10 | — | — | Cape Town & Dis., Ltd. | 1½—2½ | — | .. |
| 100,000 | 10 | — | — | Do. 4½ p.c. Pref. | 4—6 | — | 4½ |
| 100,000 | Stk. | June 26 | 4½ | Do. 4½ p.c. Deb. Stk. | 70—75 | 6 0 0 | .. |
| 157,150 | Stk. | Feb. 26 | 5 | Chester 5 p.c. Ord. | 109—110 | 4 10 11 | .. |
| 1,513,280 | Stk. | Feb. 12 | 5/9/4 | Commercial 4 p.c. Stk. | 106—108 | 5 1 2 | .. |
| 560,000 | ,, | ,, | 5½ | Do. 3½ p.c. do. | 103—105 | 5 1 6 | .. |
| 475,000 | ,, | June 11 | 8 | Do. 3 p.c. Deb. Stk. | 69½—71½ | 4 3 11 | .. |
| 800 000 | Stk. | ,, | 4 | Continental Union, Ltd. | 76—79 | 5 1 3 | 39 |
| 200 000 | ,, | ,, | 7 | Do. 7 p.c. Pref. | 115—118 | 5 18 8 | .. |
| — | — | — | — | Croydon B and C 7 p.c. | .. — | — | .. |
| 492,270 | Stk. | — | 6 | Derby Con. Stk. | 123—125 | 4 16 0 | .. |
| 55,000 | ,, | — | 4 | Do. Deb. Stk. | 102—104 | 3 16 11 | .. |
| 1,002,180 | 10 | July 29 | 10 | European, Ltd. | 17½—18 | 5 11 1 | .. |
| 16,362,910 | Stk. | Feb. 12 | 4/17/4 | Gas { 4 p.c. Ord. | 98—102 | 4 15 6 | 78½—79¾ |
| 2,600,000 | ,, | ,, | 8½ | Gas { 8½ p.c. max. | 76—79 | 4 8 7 | .. |
| 4,062,235 | ,, | ,, | 4 | Light { 4 p.c. Con. Pref. | 96—99 | 4 0 10 | 72½—73 |
| 4,674,850 | ,, | June 11 | 8 | and { 8 p.c. Con. Deb. | 72½—74½ | 4 0 6 | 62—63½ |
| 190,000 | ,, | ,, | 10 | Coke { 10 p.c. Bonds | .. — | — | .. |
| 258,740 | Stk. | Mar. 12 | 5 | Hastings & St. L. 3½ p.c. | 87—89 | 5 12 4 | .. |
| 70,000 | 10 | April 29 | 11 | Hongkong & China, Ltd. | 16½—16¾ | 6 11 4 | .. |
| — | — | — | — | Hornsey 7 p.c. | .. — | — | .. |
| 131,000 | Stk. | Mar. 12 | 7¼ | Ilford A and C | 151—154 | 5 2 4 | .. |
| 65,780 | ,, | ,, | 6⅜ | Do. B | 115—118 | 5 8 0 | .. |
| 65,500 | ,, | June 26 | 4 | Do. 4 p.c. Deb. | 92—94 | 4 5 1 | .. |
| 4,940,000 | Stk. | May 14 | 9 | Imperial Continental | 150—160 | 5 12 6 | 57 |
| 1,235,000 | Stk. | Feb. 12 | 8½ | Do. 8½ p.c. Deb. Red. | 84—86 | 4 1 5 | 63½—69 |
| 200,242 | Stk. | Mar. 12 | 6⅔ | Lea Bridge Ord. 5 p.c. | 119—121 | 5 7 5 | .. |
| 561,000 | Stk. | Feb. 26 | 10 | { Liverpool 5 p.c. Ord. { A | 211—213 | 4 13 11 | .. |
| 718,100 | ,, | ,, | 7 | { { B | 146—14 | 4 14 7 | .. |
| 305,083 | ,, | June 26 | 4 | Do. 4 p.c. Pr. Deb. Stk. | .. — | — | .. |

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. July 30. | Yield on Highest Closing Price. | Lowest and Highest Prices of Bargains. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | £ s. d. | |
| 75,000 | 5 | June 11 | 6 | Malta & Mediterranean | 4¼—4⅝ | 6 9 9 | .. |
| 250,000 | 100 | April 1 | 4½ | Met. of Melbourne { 4½ p.c. Deb. | 99—101 | 4 9 1 | .. |
| 541,920 | 20 | May 28 | 4 | Monte Video, Ltd. | 11½—12 | 6 13 4 | .. |
| 1,775,892 | Stk. | July 29 | 4½ | Newc'tle&G'tesh'd Con. | 98½—99½ | 4 10 6 | 85 |
| 529,705 | Stk. | June 26 | 3½ | Do. 3½ p.c. Deb. | 82—83 | 4 4 10 | .. |
| 55,940 | 10 | Feb. 26 | 7/14/0 | North Middlesex 7 p.c. | 14—16 | 5 2 8 | .. |
| 300,000 | Stk. | May 14 | 8 | Oriental, Ltd. | 117—122 | 6 11 2 | .. |
| 60,000 | 5 | Mar. 26 | 10 | Ottoman, Ltd. | 7½—7⅝ | 6 9 0 | .. |
| 60,000 | 50 | Feb. 26 | 13 | Portsea, Island B | 128—131 | 4 19 8 | .. |
| 100,000 | 50 | ,, | 12 | Do. C | 118—121 | 4 19 2 | .. |
| 52,000 | 50 | ,, | 10 | Do. D | .. — | — | .. |
| 249,980 | 5 | April 29 | 8 | Primitiva Ord. | 5¼—6 | 6 18 4 | 2 17/32—2⅝ |
| 499,960 | 5 | June 26 | 5 | ,, 5 p.c. Pref. | 4½—5 | 5 0 0 | 3 5/32—3⅜ |
| 521,600 | 100 | June 2 | 4 | ,, 4 p.c. Deb. | 91—93 | 4 6 0 | .. |
| — | — | — | — | ,, ,, ,, 1911 | .. — | — | .. |
| 346,198 | Stk. | June 26 | 4 | River Plate 4 p.c. Deb. | 85—87 | 4 12 0 | .. |
| 150,000 | 10 | May 14 | 6 | San Paulo { 6 p.c. Pref. | 10½—11 | 5 9 1 | .. |
| 125,000 | 50 | July 1 | 5 | { 5 p.c. Deb. | 47—49 | 5 2 0 | 88—88⅛ |
| 135,000 | Stk. | Mar. 12 | 10 | Sheffield A | 228—234 | 4 9 8 | .. |
| 209,984 | ,, | ,, | 10 | Do. B | 232—234 | 4 9 8 | .. |
| 533,500 | ,, | ,, | 10 | Do. C | 230—232 | 4 10 1 | .. |
| 90,000 | 10 | May 28 | 9 | South African | 10½—11½ | 7 16 6 | .. |
| 6,429,895 | Stk. | Feb. 12 | 5/4/0 | South Met., 4 p.c. Ord. | 111—113 | 4 16 8 | 80—82 |
| 1,895,445 | ,, | July 10 | 8 | Do. 3 p.c. Deb. | 73½—74½ | 4 0 6 | .. |
| 309,820 | Stk. | Feb. 26 | 8½ | South Shields Con. Stk. | 157—159 | 5 6 11 | .. |
| 952,795 | Stk. | Feb. 26 | 6 | S'th Suburb'n Ord. 5 p.c. | 114—116 | 5 8 6 | .. |
| 60,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 110—112 | 4 9 9 | .. |
| — | — | — | — | Do. West Kent. | .. — | — | .. |
| 137,058 | ,, | June 26 | 5 | Do. 5 p.c. Deb. Stk. | 116—118 | 4 4 9 | .. |
| 629,740 | Stk. | May 14 | 5 | Southampton Ord. | 99—102 | 4 18 0 | .. |
| 120,000 | Stk. | Feb. 12 | 7½ | Tottenham { A 5 p.c. | 125—128 | 5 8 8 | .. |
| 742,275 | ,, | ,, | 6⅔ | District { B 5½ p.c. | 115—117 | 5 2 7 | 102¾—103 |
| 181,255 | ,, | June 26 | 4 | { 4 p.c. Deb. | 87—89 | 4 9 11 | .. |
| 182,380 | 10 | Dec. 30 | 5 | Tuscan, Ltd. | 5—6 | 8 6 8 | .. |
| 149,900 | 10 | July 1 | 5 | Do. 5 p.c. Deb. Red. | 93—95 | 5 5 8 | .. |
| 236,476 | Stk. | Mar. 12 | 5 | Tynemouth, 5 p.c. max. | 108½—109½ | 4 11 4 | .. |
| 80,000 | Stk. | Feb. 26 | 8½ | Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c. | 151—156 | 5 7 4 | .. |
| 255,636 | ,, | ,, | 6⅔ | ,, B 5½ p.c. | 129—134 | 5 2 7 | .. |
| 108,075 | ,, | ,, | 5/17/8 | ,, C 5½ p.c. | 110—115 | 5 2 0 | .. |
| 352,000 | ,, | ,, | 6½ | Wimbledon 5 p.c. | 117—122 | 5 0 6 | .. |
| 98,000 | ,, | ,, | 6½ | Epsom 5 p.c. | 121—126 | 5 5 2 | .. |
| 88,416 | ,, | June 26 | 3 | 5 p.c. Deb. Stk. | 86—89 | 4 6 11 | .. |

**WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."**

**Appointments, &c., Vacant.**

LADY CANVASSER. No. 6090.
COKING AND BYE-PRODUCTS WORKS CHEMIST. No. 6085.
GAS-WORKS CHEMIST. No. 6086.
CHIEF CLERK. No. 6088.
DRAUGHTSMAN. No. 6089.

**Appointments, &c., Vacant** (*continued*).

EDUCATED LADIES FOR GAS SHOW-ROOMS. No. 6087.
FOREMAN. East Hull Gas Company.
GAS-FITTERS. Swansea Gas Company.
SLOT-METER COLLECTOR. Oldbury Gas-Works.
FITTER. No. 6084.

**TENDERS FOR**

**Tar.**

CLONMEL CORPORATION GAS COMMITTEE. Tenders by Sept. 30.

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